This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

LANE

MEDICAL LIBRARY

SEAL OF THE LELAND STANFORD JUNIOR UNIVERSITY
SEMPER VIRENS
1885

LEVI COOPER LANE FUND

LECTURES

ON

DISEASES OF BONES AND JOINTS

By the same Author

A MANUAL OF THE DISEASES OF THE EYE. Third Edition, with Coloured Plates and Wood Engravings, Fcap. 8vo.

Also

A HISTORY OF ASIATIC CHOLERA. Second Edition, 8vo.

LECTURES

ON

DISEASES OF BONES AND JOINTS

LANE LIBRARY

BY

C. MACNAMARA, F.R.C.S. ENG.

SURGEON AND LECTURER ON SURGERY AT THE WESTMINSTER HOSPITAL
SURGEON TO THE ROYAL WESTMINSTER OPHTHALMIC HOSPITAL
SURGEON-MAJOR H.M. INDIAN MEDICAL SERVICE

SECOND EDITION

of Medicine,
RARY,
St., New York.

MEDICINA LITTERIS

LANE MEDICAL LIBRARY
14783
SAN FRANCISCO

LONDON
J. & A. CHURCHILL, NEW BURLINGTON STREET
1881

EW

LANE LIBRARY

M684
M16
1881

THIS VOLUME

IS

DEDICATED BY THE AUTHOR

TO

PROFESSOR HUMPHRY, M.D. (CANTAB.), F.R.S.,

IN ADMIRATION OF HIS PERSEVERING ENERGY IN THE
CAUSE OF MEDICAL EDUCATION,
AND FOR THE PART WHICH HE HAS TAKEN IN PROMOTING
THE BEST INTERESTS OF MEDICAL SCIENCE IN HIS
OWN UNIVERSITY.

PREFACE.

Two years have elapsed since the first Edition of this work was published. I trust that the additional labour bestowed upon it may make the volume still more deserving alike of medical students and the profession. The plan of the work has been altered so as to include lectures on diseases of the joints, and the greater part of the volume has been re-written.

These lectures were not delivered as they appear in print, but are rather a compilation of my every-day teaching in the wards of the Westminster Hospital. A surgeon, whose mind is engaged in his work, can hardly visit his hospital patients and make the necessary inquiries concerning the cases under his charge, without giving instructions to students going round the wards with him; but the value of such instruction is greatly enhanced if the surgeon explains the nature of the various cases to his pupils. To acquire knowledge, however, by this kind of teaching is a slow process, so tedious that few students appreciate the advantage of watching a patient day by day to his recovery, or to the examination which is made after death. Nevertheless, there can be no question that experience acquired in this way is the only true foundation upon which a young medical man can safely rely during his professional career. My aim has been to lead my pupils, by the exercise of their sight, touch, and hearing, to gain a practical knowledge of surgery, which in systematic lectures or books they can only imperfectly receive from the description of others.

I have endeavoured to help my pupils to follow the progress of the cases under my care in the hospital, explaining to them the nature of the diseases from which my patients were suffering, and in the following lectures I have attempted to give expression to this kind of teaching. The reader must judge how far I have succeeded in effecting my object. I can only hope that the absence of precision in the following pages, may, to some extent, be atoned for by the effort made to portray the various diseases referred to as they have been witnessed and described at the bedside of my patients.

Much of this volume has been formed from materials collected by my hospital dressers, who have kept the records of cases for me. A post of this kind is one of considerable responsibility, not only as regards the interests of the individual who holds it, but also with reference to the good of the patients and the advancement of science. I take this opportunity of thanking my dressers for the work they have done for me in the wards of the Westminster Hospital.

In conclusion, I have to tender my best thanks to my friend, Dr. Theodore Maxwell, of Woolwich, for the kind help he has given me in revising these pages as they passed through the press.

13, GROSVENOR STREET WEST,
March, 1881.

CONTENTS.

LECTURE I. PAGES

DEVELOPMENT AND GROWTH OF BONE ... ... 1—23

LECTURE II.

SEPTICÆMIA AND PYÆMIA—ACUTE OSTEO-MYELITIS —ABSCESS OF BONE ... ... 24—62

LECTURE III.

ACUTE EPIPHYSITIS AND SUPPURATIVE PERIOSTITIS 63—86

LECTURES IV. AND V.

TUBERCULOUS, OR SCROFULOUS, AFFECTIONS OF BONE 87—127

LECTURE VI.

SYPHILITIC DISEASE OF BONE ... ... 128—159

LECTURE VII.

RICKETS ... ... 160—187

LECTURE VIII.

HYPERTROPHY—HYPEROSTOSIS—DIFFUSE SCLEROSIS OF BONE ... ... 188—210

LECTURE IX.

MOLLITIES-OSSIUM AND DEGENERATION OF BONE. . 211—237

LECTURE X.

PAGES
CONTUSION, FRACTURE, NECROSIS, AND ULCERATION OF BONE ... ... 238—282

LECTURE XI.

EXOSTOSIS—CYSTIC AND VASCULAR TUMOURS OF BONE—OSTEO-CHONDROMA... ... ... 283—305

LECTURE XII.

OSTEO-SARCOMA AND CARCINOMA ... ... 306—337

LECTURE XIII.

DISEASES OF JOINTS—SYNOVITIS—STIFF JOINTS—GRANULAR DISEASE OF THE SYNOVIAL MEMBRANE (SCROFULOUS SYNOVITIS) — HYDROPS ARTICULI ... ... 338—385

LECTURE XIV.

CHRONIC OSTEO-ARTHRITIS—ATAXIC ARTHROPATHY 386—405

LECTURE XV.

DISEASES OF SPECIAL JOINTS—OF THE HIP, THE KNEE, AND ANKLE-JOINTS ... ... 406—475

LECTURE XVI.

DISEASE OF THE WRIST-JOINT—THE ELBOW AND SHOULDER-JOINTS—DISEASE OF THE SPINE AND SACRO-ILIAC JOINT—COCCYDYNIA ... ... 476—530

APPENDIX—CASE OF EPIPHYSITIS AND SEPTICÆMIA—CASE OF WOUND OF PERINEUM, FOLLOWED BY SEPTICÆMIA ... ... 531—543

INDEX ... ... 545—551

CLINICAL LECTURES.

LECTURE I.

DEVELOPMENT AND GROWTH OF BONE.

GENTLEMEN,

AT the commencement of a course of lectures on the diseases and injuries of bone, it is necessary to explain the ideas I hold regarding the formation of the osseous tissue from temporary cartilage: authorities differ on this somewhat obscure subject, but unless we understand one another regarding the matter, my meaning, and the language I make use of, will be unintelligible to some of you.

Among the lower animals the earliest indication we have of a structure similar to that from which true bone
is produced, occurs in the propell [illegible] of ascidians,
which encloses an axial organ, co [illegible] cells; these
cells secrete a f [illegible] isting of an
homogeneous [illegible] the ch
dorsalis of [illegible] strict
the outer [illegible] ch [illegible] oped,
[illegible] yo [illegible] e of
[illegible] aul [illegible] derive

mesoderm, which subsequently become separated from one another, forming what is called temporary cartilage, and this gradually assumes the general shape of the future bones.

You are probably aware that cartilage is one of the large and important class of tissues known as *connective substances;* in this group are also included the cellular, connective, gelatinous, fibrous, and osseous tissues—the white blood-corpuscles probably belong to this group. Granting, however, that these structures are closely allied to one another, and that under certain conditions one tissue may be changed into another, or into something closely resembling the original, we must, nevertheless, bear in mind the fact that each of these structures corresponds to "one of the fundamental qualities of protoplasm." In other words, as the embryonic cell, from which the connective substances are derived, grows, the bulk of its descendants, influenced by hereditary tendencies and surrounding conditions, become permanently altered in their physiological properties. The new cell formations produced under these circumstances, if healthy, are stamped with an indelible mark, and, in obedience to the laws of division of labour, they have to perform their fixed and settled office in the economy, affected for good or evil by favourable or adverse surroundings, probably each one of them being susceptible to peculiar influences which may be innocuous to other tissues.

It is true that hyaline cartilage, with which we are more particularly concerned, like the other members of the connective substance group, may undergo gradual changes, and so be converted into fibrous tissue; but, as a rule, alterations in the histological arrangement of these tissues are restricted to modifications in form, which have been prefigured at some period of the growth of the tissue. For instance, hyaline cartilage, when fully formed, can seldom be demonstrated to consist of cells prolonged into fine branches, the processes of one cell communicating with those of other cells, and so forming a tolerably perfect fibrous tissue, and yet this is unquestionably a fact, and may be distinctly seen in specimens of embryonic cartilage. The protoplasm of the mature cartilage-cell produces, or secretes, a considerable quantity of inter-cellular material, which forms the hyaline matrix of cartilage, and this material closes up the inter-communicating processes of the young cells. But we can readily understand, if the material necessary for the formation of this secretion by the protoplasm be deficient in the blood, or if the living nucleus of the cell be interfered with in its healthy functions, the formation of the inter-cellular material will be modified or even suspended, the processes surrounding the cartilage-cells again becoming apparent, a reversion, or, as we commonly say, a degeneration into fibrous tissue taking place. In respect, however, to its cells, cartilage is closely allied to bone, being, indeed, "only distinguished from it by the character of its inter-cellular substance."

In the human subject the earliest indication we have of the transformation which the temporary cartilage is destined to undergo, occurs at determinate points in its interior, known as centres of ossification.

At a period in the life of the embryo, varying much in different bones, vessels from the surrounding soft structure grow into the temporary cartilage at definite points; these blood-channels, in the first instance, terminate in a plexus, and around this tuft of vessels ossification commences in the cartilage.

If well-injected and stained sections of temporary cartilage are examined at points corresponding to the future centres of ossification, we find that until vessels have permeated the cartilage, the nuclei of the cartilage-cells are small and uniformly scattered throughout the hyaline matrix. No sooner, however, does the blood circulate through the newly-formed vessels which have penetrated the cartilage, than the protoplasm of the cells in proximity to the blood-channels begins to grow. In fact, the nuclei of the temporary cartilage cells within a limited area of the terminal plexus of vessels multiply, active proliferation of the protoplasm occurring in consequence of the power exercised by the blood over the living matter contained in the cells. The original cartilage nuclei having proliferated exceedingly, the new cells arrange themselves in rows, passing away from the primary vascular plexus in the direction of the growth of the bone; other vessels bud out from those first formed in the cartilage, and these new blood-channels elongate in the direction the cells have taken, and anastomose with other vessels, which penetrate from the surrounding soft tissues into the cartilage.

No sooner has the cartilage-protoplasm formed itself into rows of new cells, than we observe inorganic matter in the matrix of the cartilage between these rows of cells. But this earthy matter is not deposited entirely in the homogeneous material between the rows of newly-formed cells; on the contrary, in well-prepared specimens, portions of the protoplasm of the original cartilage-cells may be found scattered throughout the lines into which the inorganic matter is being secreted. These portions of the cartilage-protoplasm become surrounded by bone earth, and are the first indications of the future lacunæ or bone-corpuscles, so that during the earliest period of the development of bone we notice vessels passing into the temporary cartilage at determinate points. Around these, rapid growth of the protoplasm contained in the neighbouring cartilage-cells occurs, the newly-formed cells arrange themselves in the direction of the future growth of the bone, lacunæ or bone-corpuscles then arising in the intervals between these rows of cells, forming the commencement of the cancelli (trabeculæ) or cancellated tissue of the future bone, the rows of cells between the cancelli representing the earliest stage of the medulla. In addition, these spaces between the cancelli contain blood-channels, and subsequently are crowded with small round cells, fat-corpuscles and so on; but among them, especially in the young and growing bone, a number of larger compound or myeloid cells may be seen, these are constituted of clusters of protoplasm derived from the original cartilage cells. It was by the action of the blood on the cartilage-protoplasm that the bone was first developed, and it is through the continued action of this protoplasm that bones increase in length and are repaired after injury. In the absence of this form of living matter no perfect bone can be produced; if the protoplasm be defective through hereditary faults its action is impaired, and so the outcome of its work is imperfect. On the other hand, the protoplasm may be healthy, but its surroundings, especially the blood supply, being abnormal, the living matter is unable to perform its functions, and so fails to build up a perfect osseous tissue.

If we examine the walls of the cancelli of bone before the spaces between them have become crowded with cells—that is, before the structure known as the medulla has been fully elaborated—we observe adhering to the sides of the cancelli isolated portions of protoplasm which is undergoing transformation into bone-corpuscles. The protoplasm adhering to the walls of the cancelli surrounds itself by a layer of soft homogeneous matter, which collectively forms the organic matrix of bone; into this soft matter bone earth is subsequently deposited, and so the bulk of the cancelli is augmented by the formation of bone from layers of cartilage-protoplasm. As Mr. Bowman wrote some forty years ago, "It hence appears that after ossification of the inter-cellular substance, the rows of cartilage-cells arrange themselves on the inner surface of the newly-formed cancelli, and become ossified, with the exception of their nuclei, which remain granular, and subsequently form the lacunæ of bone."

Dr. Ogston, of Aberdeen, remarks on this subject, at the line of transformation of cartilage into bone, "the prominences are really groups of cartilage-cells which have undergone alteration. The alteration consists of a transformation into a tissue not to be distinguished from medullary tissue, such as occupies the cancelli of the spongy bones; the masses of granulation tissue thus formed are next transferred into true bony tissue; on the surface of the layer next the bone the cells become transformed into bone-corpuscles."

In most bones ossification commences at more than one spot. In the long bones, for instance, there is generally a point of ossification in the centre of the shaft, and one or more at each extremity to form the articular surfaces and eminences. The central part of the growing bone is called the *diaphysis*, and for a long time after birth there remains a layer of unossified cartilage between this and each of the epiphyses, as the extremities are called. Processes of bone have usually their own centres of ossification, and are termed epiphyses until they have grown into the diaphyses, after which they receive the name of apophyses.

Supposing we examine the femur, or any of the long bones, soon after birth, we find the line of junction between the diaphysis and the cartilages of the epiphyses is the most vascular part of the growing bone; not only do vessels pass to this line along the cancellated structure of the bone, but they also run into this line from the soft tissues external to the shaft. The cartilage-cells of the epiphysis at the line of ossification may be seen passing through changes precisely similar to those I have described as occurring round the vascular plexus at a centre of ossification. Rapid proliferation of the cartilage-cells takes place in the immediate proximity of the vascular area at the line of ossification; the new cells arrange themselves in rows; the formation of bone first takes place between these rows, the newly-formed bone being continuous with the cancelli of the diaphysis and the rows of cartilage-cells contained within the trabecular network of the bone. In this way the long bone increases in length at the expense of the epiphysial cartilage, which, in its turn, grows by means of an interstitial development of new cells situated in the hyaline matrix of the cartilage.

If we examine specimens of carefully-injected cartilage, we frequently observe changes such as I have noticed produced by disease. Under abnormal stimulation blood-channels sometimes stretch into the epiphysial cartilage, either from vessels in the bone or the surrounding soft structures; and along the course of these blood-channels, but especially at their termination, the cartilage-cells are converted into medulla, which in its turn is transformed into osseous tissue, and so we not unfrequently meet with isolated patches of bone in the middle of a mass of temporary cartilage.

Professor Kölliker, and also M. Ollier, have studied the subject of the growth of bone with great care. Among other methods of investigation, they fed young animals with food containing madder. The colouring matter of this vegetable substance, if introduced into the blood, stains the growing bone, and it has thus been ascertained that, in the long bones, the extremities of the diaphysis grows quickest whose epiphysis remains the longest separated, demonstrating Professor Humphry's law, that the growth of a bone is chiefly in the direction of its nutrient artery. Consequently, excision of the elbow-joint is followed by a less comparative shortening of the limb than removal of the knee-joint, because the length of the humerus is increased principally from the upper epiphysis, whereas that of the femur grows chiefly from its inferior extremity.

Short bones, with one epiphysis, grow quickest at the diaphysis touching that epiphysis (calcaneum, metatarsi, phalanges).

Bones with free edges (ilium), and some, as the ribs, provided with a considerable layer of cartilage, show a very marked growth.

Short bones, with or without epiphyses, grow equally on all cartilaginous surfaces which are in contact with other bones (vertebræ, tarsus, carpus).

Ollier not only demonstrated that the growth in length of a bône is prevented by the removal of the temporary cartilage, but that if the epiphysial cartilage of one of two parallel bones be destroyed, the other continuing to grow, an arc will be formed, the chord of which will be the shortened bone. Direct irritation of the cartilage—as, for instance, inflammation of the diaphysis—if continued so as to destroy the integrity of the epiphysis, prevents the further growth of the bone; but temporary irritation, such as cauterization of the periosteum of the end of a young bone, increases its bulk both in length and thickness.

During the time the long bones are growing in length at the expense of the epiphysial cartilage, they also increase in thickness, through the action of cells contained in the periosteum. Let us take, for example, the femur of a young child: its condyles are composed of cartilage, the periosteum being continued from the shaft of the bone over the cartilage (Fig. 1), and on examination we find that the outer layers of the cartilage are of a fibroid character. Imbedded in the fibres are a number of the original cartilage-cells—in fact, this is the way in which the periosteum is formed; its deeper layers are composed of fibro-cartilage produced from temporary cartilage. As the shaft of the bone is increasing in length at the expense of the central portion of the temporary cartilage, the outer layers of this same cartilage with its cells are being transformed into fibro-cellular tissue, the bone advancing into this covering like a finger thrust into a glove. As the bone grows in length, however, this covering is constantly being produced, for you understand that the

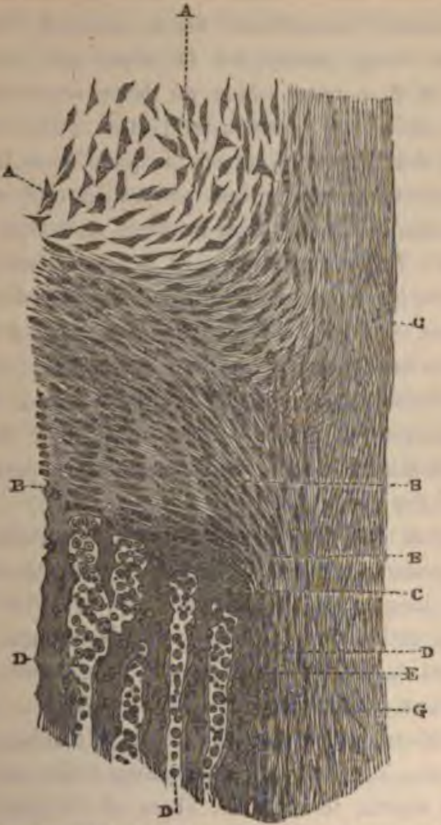

FIG. 1.—SECTION OF EPIPHYSIS THROUGH LINE OF GROWING BONE AND PERIOSTEUM.

A A, Cartilage cells. Some of them are seen to be undergoing fibroid changes.

B B, Cartilage cells rapidly proliferating and arranging themselves into rows continuous with the medullary spaces in the newly-formed bone.

D D, Nuclei of cartilage cells passing into the medullary spaces of the bone. Along the sides of these spaces some of the round cells are seen to be transforming themselves into bone corpuscles.

C C, Cartilage cells passing into and forming the deep layers of the periosteum. Some of these cells are undergoing changes into bone-corpuscles.

E E, The inner layers of the periosteum,

G G, The outer layers of the periosteum.

newly-formed fibro-cellular tissue encasing the bone contains living protoplasm of identically the same nature as that from which we have seen the shaft of the bone was constructed; the cells, however, forming the deeper layers of the periosteum have not undergone the same process of proliferation as those which constitute the bone-forming elements of the medulla. The circumference of a long bone is augmented as layer upon layer of the cells derived from the temporary cartilage ossifies. It is, therefore, a mistake to draw a hard and fast line between the deep layers of the periosteum and the shaft of the bone; the one structure merges into that of the other, the deep layers of the periosteum being as much a part of the bone as the medulla.

Professor Ranvier observes that if longitudinal sections are made through the epiphysis into the diaphysis of (the long) fœtal bones, at either extremity of the line of ossification, a notch or depression in the epiphysial cartilage may be seen. This notch in the entire bone corresponds to a circular groove. At this groove fibres, which originate in the cartilage, curve round the side of the embryonic bone and pass into its matrix, forming the fibres of Sharpey. After emerging from the cartilage, Professor Ranvier says these fibres are separated from each other by cells derived from the cartilage-cells, and which, "placed between the arciform fibres, assume gradually the characters of those cells which Gegenbaur has called *osteoblasts.*"

I am not clear as to the direction taken by the arciform fibres described by M. Ranvier; but from the specimens before us you may, I think, satisfy yourselves as to the accuracy of much of the above description. However, Mr. Schäfer declines this view, and accepts the accuracy of the well-known account of the formation of bone to be found in Quain and Sharpey's "Anatomy." I believe with Ranvier that cartilage cells may be demonstrated to pass into the periosteum in the manner I have described, although I hardly think I should have arrived at this conclusion from the examination of sections of human bones. The growth of bone from the cells of the periosteum, and the passage of cartilage-protoplasm into the periosteum may be studied with advantage among the lower classes of vertebrata; as, for instance, in transverse sections of the femur of young frogs, where the layers of cells (osteoblasts) in contact with the external surface of the bone can be satisfactorily demonstrated to be the agent by means of which the shaft of a long bone increases in thickness, and this deep layer of the periosteum may certainly, I believe, be shown to originate in the cartilage of the epiphysis.

It is not many years since pathologists were divided in their opinion as to whether the periosteum had any influence in forming bone, many believing that the new bone produced in cases of necrosis, or after a fracture, was due to an expansion or growth from the old bone. Other observers maintain, in instances of necrosis or after mechanical injury, that in consequence of the increased action in the part, an effusion of organizable lymph took place into the surrounding soft textures, which effusion served as a material or foundation for the new shell of bone, the lymph taking up "the ossifying process so soon as it was communicated to it from the living bone."

With reference to these ideas, Mr. Syme, in the year 1837, published the results of the following experiments. He exposed the radius of a dog, and removed an inch and three-quarters of the bone in one fore leg, together with the periosteum. He took another dog and removed a corresponding portion of bone subperiosteally. Six weeks afterwards the dogs were killed and the bones examined. In the one from which a portion of bone had been taken together with the periosteum, the extremities of the bone were found extended towards each other in a conical form, with a deficiency of bone between them. In the other, where bone had been removed, but the periosteum covering it had been allowed to remain, there was a compact mass of bone, rather exceeding in size the portion of bone which had been removed. Mr. Syme next exposed the radius of another dog, and separated the periosteum from the bone, inserting a piece of metal between it and the surface of the bone. In another dog he excised a portion of the periosteum, and in its place laid a metallic plate on the bone. In the first instance a layer of bone formed in six weeks external to the metallic plate; in the second, no osseous substance was produced either above or beneath the metallic plate.

Experiments such as these seemed to settle the question as to the power possessed by the periosteum in forming osseous tissue independently of the bone. And if lymph effused about an injured bone were capable of receiving a stimulus from the bone, or of itself initiating the idea that its office was to build up new osseous tissue, it seems difficult to account for the fact that new bone was not produced to fill up the cavity in the radius after Mr. Syme had excised a portion of the shaft of the bone together with the periosteum covering it. On the other hand, the periosteum, like other structures, is greatly influenced by locality, or the conditions by which it is surrounded. The subperiosteal layers, when subjected to great injury, as after the fracture of a bone, contribute to repair the fracture by first passing into a cartilaginous condition, and subsequently forming bone. If the subperiosteal cells are only slightly irritated, they are frequently directly transformed into bone, producing osseous tissue in precisely the same way as the cells contained in the medulla of bone do after a simple fracture.

In some experiments lately made by MM. Rigal and Vignal, pupils of M. Ranvier's (see *Lancet*, p. 345, 1880) attempts were made to obtain bony tissue from medulla transplanted into the subcutaneous cellular tissue, but all failed, while subperiosteal tissue thus transplanted invariably produced bone which was at first cartilaginous, as M. Ollier had already found. From the lower third of the tibia of a rabbit the periosteum was removed three or four times, so as to destroy all its osteogenic properties. Then, fifteen days after the last removal, the bone was broken in the middle of the denuded portion. Twelve days later, a period at which, in the rabbit, a cartilaginous callus is usually found, the animal was killed, and the examination of the fracture showed that in the midst of granulations proceeding from enlarged Haversian canals, there was a peripheral callus, purely bony. The experiment was repeated several times with the same result. A still more conclusive experiment was the one in which the periosteum was removed from one surface only, and the bone then broken. Upon that surface the osseous callus formed directly, as in the case of compound fractures, while upon the surface on which the periosteum was preserved the callus was cartilaginous. These experiments show that the subperiosteal layer, when there is active irritation, as in the case of fractures, contributes to reparation by forming cartilage. But there are numerous cases in which the subperiosteal tissue forms bone directly, and experimentally it could be made to form bone or cartilage at will; with slight irritation bone is formed, with greater irritation cartilage. In the same animal the periosteum was exposed on both legs; on one it was irritated gently by rubbing (as with an agate burnisher), and in the other leg it was irritated strongly, and the adjacent soft parts were bruised, so as to cause an extravasation: if union of the wounds by first intention was obtained, in the former osteophytes were found beneath the periosteum on the twelfth day, while in the latter there were only cartilaginous masses. The latter experiment explains the direct formation of bone at the points of the callus which are farthest from the fracture. In the experimental fractures it was invariably found that in the extremities of the oval mass of callus, bone was formed at once—the inflammation at these points being less active, the subperiosteal cellular layer formed bone immediately.

The extremities of the long bones are surrounded by a thin layer of compact osseous tissue, but the bulk of the spongy portion of these bones is constructed of a number of trabeculæ, the spaces between them being filled up with soft tissues (medulla), which play the most important part in the various forms of disease we shall have to consider. And let me here remark that these soft tissues are continuous with those occupying the medullary canal, and that they also abut on the attached surface of the articular cartilages, filling more space in the spongy portion of bones than the osseous trabeculæ.

The greater number of vessels passing into the extremities of the long bones are derived from vessels perforating the periosteum and outer thin layer of bone, and not from the nutrient artery; for instance, the vessels of the lower end of this femur have been injected from the popliteal artery. This anatomical arrangement of the vessels will in some measure explain the fact, that in certain cases well-regulated and continuously applied pressure round the lower end of the femur may influence inflammatory changes going on in the bone, the blood-supply to its spongy tissue being thus materially affected. In fact, if we smear a thick layer of extract of belladonna and mercurial ointment over the skin covering the condyles of the femur and knee-joint, and encase the whole in well-applied strapping or an india-rubber bandage, we place the inflamed intra-osseous structures in much the same condition, with reference to their supply of blood, as the iris is in after the pupil has been fully dilated with atropine for the cure of iritis. The volume of blood circulating in the bone would, under these conditions, be restricted, and the part kept at rest—two important elements in the successful treatment of inflammation; and I need hardly observe that the same remark applies to other parts in which the interior of the bones is filled with medulla supplied with blood from the vessels in the surrounding soft structures, and which can be compressed by means such as those above referred to.

If we examine the soft structure in the cancellated tissue, we shall discover that it is fairly well supplied with blood—many of the smaller vessels course along the walls of the trabeculæ, while others stretch across the inter-trabecular spaces; the smaller arteries pass into larger thin-walled blood-spaces, much the same as we see in the cavernous splenic veins. In addition to these vessels, the spaces in the cancellated structure and the medullary canal of the long bones contain a network of adenoid or cytogenic tissue, continuous with that of the endosteum, its meshes being filled with a vast number of corpuscles which histologically, as well as functionally, resemble those contained in the spleen. In fœtal, and in fact in all bones until about the fifteenth year of age, the marrow is of a deep red colour, and it continues so in the bones of the trunk and cranium, while in those of the limbs large quantities of fat cells appear in the meshes of the adenoid tissue, and the medulla consequently becomes of a yellow colour. Authorities hold that this plexus of adenoid tissue is the commencement of the lymphatics in bones. It seems to me that in the medullary canal the evidence in favour of this view is strong, and I think we may yet demonstrate the existence of lymphatic structures in this situation similar to those of cartilage; but however this may be, we certainly find that the Haversian canals and the spaces in the cancellated structure of bone contain a network of adenoid tissue in addition to their vessels, and that these structures play an important part in inflammatory and other abnormal processes going on in the interior of the long bones.

If we examine these sections of the articular surface of the tibia which have been first coloured and subsequently rendered transparent by glycerine, we shall be able to comprehend the anatomy of the long bones immediately beneath the articular cartilages. The soft materials filling the cancelli project down to within about the tenth of a line of the attached surface of the cartilage, the medulla there terminating in bulb-like masses, from which processes branch out, unite, and form a series of arches beneath the articular cartilage. So numerous are these channels proceeding from the medullary spaces to the cartilage that the layer of compact bone they perforate may be said to be riddled with tortuous passages, and this lamina would therefore be a weak point in the bone were it not for a peculiar arrangement of its calcareous elements.

With a half-inch magnifying power we can see a number of calcareous concretions enclosing cartilage-cells, as well as a quantity of granular earthy matter dispersed in an irregular manner in the osseous lamina, between the cartilage and the cancellated structure. There is no constant system of Haversian canals or lacunæ in this dense hard lamina, but the canals extend from the medullary spaces up towards the cartilage through this calcareous layer; in fact, the vitality of the articular cartilages mainly depends upon the supply of blood contained in the medulla passing through these canals up to the attached surface of the cartilages.

The growth of this dense lamina of bone from the articular cartilage-cells was described by Dr. Ogston, in the "Journal of Anatomy and Physiology," for October, 1875; my own observations lead me to confirm the correctness of the conclusions arrived at on this subject by Dr. Ogston. Portions of the end of one of the long bones, with their articular cartilages attached to them, having been decalcified by soaking for some weeks in a weak solution of chromic and nitric acids, perpendicular sections to the surface of the bone must be made, and subsequently stained with logwood. In this way we may see imbedded in the lamina of bone which separates the articular cartilage from the cancellous tissue, a number of rounded groups of cells which cannot be distinguished from similar clusters of cells to be found in the "medullary tissue, such as occupies the cancelli of the spongy bones." It is not uncommon to see some few of the cells at the circumferences of the groups above referred to, undergoing transformation into bone-corpuscles. In the fully formed bone we may notice that the cells of the articular cartilages where they impinge on the calcareous lamina, having proliferated, loose their capsules, and then arrange themselves in elongated groups of round cells, looking like processes of granulation tissue. While these changes are in progress the hyaline material between the groups of cells becomes infiltrated with bone earth, so that clumps of the descendant of the cartilage-cells are imbedded in a dense earthy layer constituting the calcareous lamina of bone, which is, therefore, constantly being renewed from the cells of the deeper layers of the articular cartilage. If such were not the case this lamina of bone would speedily be destroyed by the pressure to which it is exposed; and if destroyed the soft cancellated tissue of the bone would be laid bare, as it is in fact in certain forms of disease, as, for instance, in ataxic arthropathy; in this affection, the articular cartilages being destroyed, the calcareous lamina wastes away, and not being renewed, the soft cancellated structure of the bone is laid bare, presenting a carious appearance when the diseased joints are cut into.

We may gain some practical hints from a consideration of the circumstances of the subcartilaginous layer of bone, for so long as this lamina remains, it is almost impossible for bony anchylosis to occur between the extremities of contiguous bones.

In a considerable number of specimens of chronic inflammation of the cancellated tissue of the long bones, I find the calcareous lamina and the trabeculæ in the cancellated tissue of the ends of the bone much thickened, so that the medullary structure of one bone has been effectually separated from that of the other bone entering into the formation of the joint. Under these conditions bony anchylosis is impossible; but if the structures intervening between the medulla on either side of a joint are removed by the hand of the surgeon or by disease, then bony union may occur. It is the existence of this subcartilaginous layer of bone that is apt to prevent the cure of many cases of joint disease by anchylosis.

In excising a joint we not unfrequently leave portions of unhealthy osseous tissue behind; nevertheless, anchylosis subsequently takes place between the ends of bones which had previously been in apposition for months without union, because the medullæ of the bones entering into the formation of the joint are brought into apposition. In fact, it is evident, supposing the cancellated tissues of two bones are divided by means of the subcartilaginous layer, their articular extremities can no more unite than if they were separated by a plate of mica.

I have already remarked that, in cases of chronic inflammation, sclerosis of the bone is likely to occur behind the calcareous lamina from hyperaction of the medulla, and so the bone-forming material or medulla is separated from the joint, not only by the subcartilaginous lamina, but also by means of the new bone formed beneath it. The same thing frequently occurs in ununited fractures; the medulla in the cancellated structure of the ends of the bones ossifies, and effectually prevents the bone-forming elements from one end of the fracture uniting with those of the other, and so repairing the injury. If we wish to overcome this difficulty we must remove the whole of the sclerosed ends of the bones and bring the healthy medullæ of the fragments into apposition; if we then keep the parts properly at rest we may fairly expect union to occur; but neither pegs inserted into the sclerosed ends of the bone nor any other mechanical contrivance can effectually bring about the union of an ununited fracture, unless we remove the obstacle, whatever it may be, which separates the medullary structures of the ends of the bone from coming into contact with one another and growing together.

LECTURE II.

SEPTICÆMIA AND PYÆMIA—ACUTE OSTEO-MYELITIS—ABSCESS OF BONE.

I SHALL have to refer so frequently in this and subsequent Lectures to the conditions known as septicæmia and pyæmia, that it will save reiteration, and perhaps some misunderstanding, if I explain the meaning I attach to these terms. When the life of any portion of the body has been destroyed, its elements undergo certain changes resulting in new combinations, some of which, when introduced into the circulation, cause the symptoms characteristic of septicæmia; others produce the phenomena known as pyæmia, but in many cases of blood-poisoning septicæmia and pyæmia run their course simultaneously. Under these circumstances, a patient is said to be suffering from septo-pyæmia.

Septicæmia is divided into two classes—the first, known as *septic intoxication*, in which condition the poison absorbed into the circulation, although derived from the products of decomposing matter, is not infective, that is, it does not multiply itself in the blood, the poison acting in the same manner as some chemical substances do. Ordinary surgical fever is an instance of this form of septicæmia.

The second form of septicæmia is that known as *septic infection*, which has been described "as a general infective process, arising from the introduction of some peculiar constituent of putrid matter into the blood." This condition is supposed by some authorities, with good reason, to arise from the multiplication of living organisms in the blood, derived from putrid matter; by others it is thought to depend upon the effect of a non-organized ferment. From a clinical point of view, however, we cannot distinguish these forms of septicæmia from one another, for they give rise to the same train of symptoms. But there can be no question that these symptoms vary in intensity, and are modified according to the tissues through which the septic poison enters the blood. The products of chronic inflammation of various structures, particularly of the bones and the genito-urinary organs, usually give rise to a less deadly form of blood-poisoning than that caused from the absorption of putrid matter resulting from acute osteomyelitis, or from traumatic injuries about the membranous portion of the urethra. For instance, we lately had a patient in the Henry Hoare ward, suffering from gleet and muco-purulent synovitis of both knee-joints. This man was suddenly attacked with sclerotitis, and in the course of a few days with muco-purulent conjunctivitis in both eyes, accompanied with a rapid rise in the temperature of his body, intense headache, and marked weakness of the heart's action. Mr. George

Lawson, in his work on diseases of the eye, mentions a somewhat similar case. His patient had three separate attacks of inflammation of the eyes, commencing on each occasion shortly after he had contracted a fresh gonorrhœa. Mr. Lawson remarks, "The purulent discharge was so copious that I thought it must have been caused by inoculation, but its reappearance in both eyes with the recurrence of the urethral discharge has now convinced me that it was due to other causes. I should add that this patient with each attack of gonorrhœa suffered from rheumatism," symptoms, which I believe arose from the absorption of matter into the blood, but this matter, having to pass from the urethra into the venous sinuses of the penis, induced a train of symptoms differing in severity from those presented by a patient whose case will be found given in detail in Appendix A. of this volume. The patient suffered from acute osteo-myelitis and septicæmia; the putrid matter from the inflamed medulla, being absorbed directly into the open veins contained within the cancellated tissue of the tibia, produced a train of symptoms similar in character, but of far graver results, than those manifested by the patient referred to by Mr. Lawson.

But we constantly hear people argue, that if putrefying matter entering the circulation is so dangerous in its effects, amputation of the finger, or even a prick of an hypodermic syringe would frequently be attended with serious consequences. To this argument we may reply, is it possible to account for the fact, that of a hundred people exposed to cold and damp ninety-nine escape unharmed, while one is attacked by rheumatism and another by pleurisy? Or again, how is it that many people exposed to the influence which causes Asiatic cholera and typhoid fever, remain free from these diseases? Lastly, a surgeon may go through a long course of dressing wounds, post-mortem work, and so on, without experiencing any ill effects from his occupation, when without any apparent change in his circumstances he is seized with erysipelas, or poisoned by a prick in his finger. When we have mastered the difficulties involved in these problems we may, perhaps, be in a position to understand why septic poisons have more influence upon one person than another, or on the same individual at different times. In the meanwhile we should evidently guard our patients as far as possible from the deadly effects which not unfrequently follow the absorption of putrid matter into the circulation.

Symptoms of Septicæmia.—Septicæmia occasionally destroys a patient in a few days after the first introduction of the poison into the blood. It may be a week, or even more, after suppuration (not necessarily from an open wound or an injury) has commenced, that symptoms of septic poison, of a most deadly character, manifest themselves. The patient becomes feverish, the temperature of his body rising rapidly, perhaps to 107°, but not falling below 104°, his breathing is extremely quick, there is sudden failure of the heart's action due to paralysis of its muscular fibres, a clot forms on the right side of the heart extending into the pulmonary arteries, and death follows very suddenly.

Fortunately, however, in the majority of cases septicæmia develops itself gradually; as I have before remarked, it is by no means necessary that the disease or injury from which the septic matter is derived should have been exposed to the influence of the atmosphere. The patient suffers from continued or remittent pyrexia, the temperature of his body varying from 101° to 105°. The pulse is small and feeble, the respiration rapid. There is great thirst, dry tongue, and want of appetite. The patient complains of severe headache, and delirium frequently sets in at the commencement of the symptoms, especially at night. The skin is hot and dry, and frequently an eruption, not unlike that of measles and scarlatina combined, appears early in the course of the affection. Occasionally choleraic diarrhœa exists; the urine is scanty, high coloured, and often containing albumen. Muco-purulent or serous synovitis with rapid distension of one or more joints sometimes follows; these joint complications are more common when the septicæmia is connected with affections of bone or of the genito-urinary apparatus, and being accompanied with fever may be mistaken for an attack of acute rheumatism. See case Appendix B.

It seems more than probable that some cases of articular rheumatism, especially that form of it known as gonorrhœal, are due to septicæmia. But the septic poison may be engendered in the sockets of decaying teeth, or other portions of dead bone, and unless the source of the purulent infection is removed the patient suffers more or less constantly from ill health, and a train of symptoms supervenes, attributable to septic poisoning, in a mild form.

After death from septicæmia we find in various parts of the body plugs of coagulated blood in the capillary vessels, with areas of ecchymosis round them. These coagula are especially numerous along the surface of the alimentary canal, the peritoneum, and also in the serous membranes. The coagula consist of organic matter probably derived from dead leucocytes, which the septic poison appears to kill. Ante-mortem coagula are found in the right side of the heart; serous or muco-purulent fluid is frequently discovered in the synovial sacs. *Metastatic abscesses are not found in the bodies of patients who have died from the effects of septicæmia.*

Symptoms of Pyæmia.—Pyæmia is essentially an infective disease, and, consequently, capable of being propagated from one person to another by the blood or discharges from a patient suffering from it. In cases of pyæmia the symptoms set in suddenly with rigors, lasting, it may be, only a few minutes, but more generally for a considerable time. The temperature of the patient's body commences to rise before the cold stage of the fever comes on; during the chills the thermometer reaches from 102° to 107°; the rigors are followed by a hot and subsequently by a sweating stage. Paroxysms of fever of this kind occur at irregular intervals, sometimes once or oftener in the twenty-four hours, but they are occasionally absent for one or two days. Whether there are rigors or not, the temperature of a patient's body suffering from pyæmia will be found to rise and fall in a remarkable manner within a very short space of time. The surface of the skin is damp, sodden, and jaundiced; the spleen is generally somewhat enlarged. There is entire loss of appetite, great thirst, thickly-coated and dry tongue, and frequently painless diarrhœa. The patient's face is haggard, his eyes lose their brilliancy, excessive bodily and great mental depression exists, with headache, and sometimes there is delirium, but in many cases the patient is perfectly conscious, and exhibits no evidence of diseased functions of the cerebrum.

As the disease advances areas of decomposing tissue occur in various parts of the body. These, so-called, metastatic abscesses, are in truth the result of putrefying matter carried by the circulating fluid from the original wound to the lungs and other organs; pieces of the decomposing matter get entangled in the smaller vessels, and there communicate an action similar to that which they are undergoing to the surrounding living tissues. But the mischief does not end here, for decaying matter is carried from these secondary centres of decomposition to other parts of the body, and thus a succession of metastatic abscesses occur. Important organs are thus destroyed, and the patient's blood becoming unfitted for its purposes, death ensues. It frequently happens that the formation of large metastatic abscesses takes place without exciting any pain or other marked symptoms in the organs implicated, and it is only by repeated and careful examination that we discover the mischief that is going on in the lungs, or in the various joints of the body, which may become rapidly distended with pus without the patient complaining of much pain in the affected limbs. As pyæmia sets in the condition of the wound in which the poison originates may present no remarkable change; but in most cases, as the disease advances, the discharge from the wound becomes of a yellowish-green colour, containing bubbles of air; there is no mistaking its fœtid smell, which odour is frequently apparent in the patient's breath, and exhalations from the surface of his body.

Pyæmia, the result of decomposing matter derived from an open wound, in by far the majority of cases ends fatally.

After death we find that the veins leading from the wound contain thrombi; in the larger veins these thrombi are found to be undergoing decomposition, and, as I have before remarked, portions of this putrefying matter find their way into the various organs of the body, so that in the greater number of cases of death from pyæmia numerous metastatic abscesses, containing organic matter swarming with micrococci, are found in the lungs, liver, and not uncommonly in the serous cavities of the body.

From a clinical point of view, we may sometimes be unable to separate instances of septicæmia from pyæmia, for the two poisons which produce the characteristic symptoms of these diseases not unfrequently exist together in the same individual. Nevertheless, there can be no question as to the fact of septicæmia running its course without the formation of metastatic abscesses, and as certainly we meet with patients who, after an accident or an operation, appear to be doing remarkably well, and are suddenly seized with rigors, which are almost invariably the sign of the commencement of pyæmia.

But as there are instances of septicæmia which run a protracted course depending very much upon the structures in which the septic matter forms, and through which it has to percolate before gaining the circulation, so from time to time we meet with instances of disease which may best be described as chronic pyæmia. In these cases there is generally no evidence of an external wound, but a large and often painless collection of matter forms, usually beneath the skin, over some part of the body. Successive abscesses of this description occur; they give the patient very little pain or inconvenience, but he suffers from a low intermittent form of fever, and in spite of any treatment we can employ, usually sinks into an emaciated condition, and, according to my experience, always dies within a few months or weeks.

ACUTE OSTEO-MYELITIS.

Acute osteo-myelitis, or inflammation of the contents of the soft structures contained within the bones, may occur either as the result of an injury, or may be idiopathic; unless when following an operation or injury to the long bones, the acute form of the disease is not very frequently met with in this country.

You are aware that in the soft tissues of the body the materials arising from the process of inflammation are, as a rule, prevented entering the blood by the contraction and plugging of the vessels surrounding an inflamed area, and also by the new cell-formations which occur in the part, hindering the absorption of putrid matter into the circulation. And there can be no doubt that in instances of chronic osteo-myelitis the Haversian canals, and contents of the cancellated structure of bone surrounding the affected area, become occluded by a process analogous to induration of the soft tissues, but which, in the case of bone, is known as sclerosis. Nevertheless, the formation of the vascular system in the osseous tissues is such as to lead to the absorption into the circulation of putrid matter formed within it, for, as I have before explained, the coats of the veins contained within bone "cannot easily unite for physiological reasons;" and hence we find that over and above the death of the bone resulting from acute osteo-myelitis, patients suffering from this form of disease run a great risk of septo-pyæmia, arising from the absorption of putrid matters from the inflamed bone into the circulation.

Acute osteo-myelitis occurring in one of the long bones after an amputation or fracture, is not unfrequently unaccompanied with pain, the medulla having sufficient space to swell, and the effusion of serum which occurs escapes from the divided bones without causing such an amount of pressure as to induce much pain; but when there has been no such injury to the bone, inflammation of the medulla occurring, perhaps, in consequence of exposure to cold, or from epiphysitis, the patient complains of intense pain within the bone, because of the unyielding nature of the structures in which the inflammatory action is taking place. So that after an amputation the first indication we may have of acute osteo-myelitis having set in is an attack of rigors consequent on the absorption of septic matter into the circulation. For instance, it may be that after an excision of the knee-joint everything appears to be going on well, and the patient is recovering from the surgical fever usually met with after an operation of this description, when he is suddenly seized with rigors, followed by a hot stage, and subsequently by profuse perspiration; paroxysms of fever occur at various intervals, accompanied by a remarkable alternation of high and low temperatures of the patient's body; his pulse and breathing are rapid; his skin and conjunctiva assume a dull, yellowish appearance; his face is haggard; general bodily and almost always great mental depression exists, with headache, often painless diarrhœa, and moderate enlargement of the spleen. But it is a mistake to depend either on the temperature chart, rigors, or any other symptom, taken by itself, as indicating the existence of pyæmia; you must study the combination of symptoms to enable you to arrive at a correct conclusion on the subject.

Supposing the symptoms after an injury to one of the bones point to septic poisoning, it is still possible that the putrid matter may have been absorbed from a collection of pus situated in the soft parts round the end of the bone, or that only limited necrosis exists. To satisfy ourselves on these matters, it is necessary to expose the injured bone, and this should be done without any unnecessary delay after symptoms of pyæmia have declared themselves. If inflammation of the medulla exists, the end of the bone, when exposed, instead of presenting a pale red and healthy appearance, will be of a dark brown, almost black, colour, except in the very early stages of the disease, when the medulla will protrude as a fungating red mass from the end of the bone, which is denuded of its periosteum. On passing a probe into the cancellated tissue or the medullary canal, it is also found denuded of its lining membrane, and a thin bloody discharge, usually containing air-bubbles, exudes along the side of the probe. The bone, in fact, is dead or necrosed, and the medullary tissue, not only in the central canal, but in the cancellated and Haversian spaces for some distance from the site of injury, is in a state of putrefaction; the absorption of this putrid matter into the system gives rise to symptoms of septic toxæmia.

Under these circumstances, the best chance we have of saving our patient's life is to amputate, or re-amputate the limb, at or beyond the joint next above the site of injury; if, for instance, the tibia is involved, amputate at the knee-joint. It is only by the removal of the diseased bone—that is, the source from which the putrid matter is being absorbed into the blood—that we can hope to preserve the patient's life.

With reference to the proper time for amputating or disarticulating a limb in cases of acute osteo-myelitis, the sooner the operation is performed the better after symptoms of pyæmia have manifested themselves; so that after rigors have occurred, if the injured bone is found to be inflamed, by far the best, in fact, the only prospect we have of saving the patient's life, is to remove the whole of the affected bone, amputating through the joint above it. In cases of septicæmia it is different (read case, Appendix A.); for instance, we had a case not long since, in the H. Hoare ward, of a primary amputation through the leg for injury of the foot. All progressed favourably until the sixth day after the operation, when the patient's temperature rose rapidly, and continued to vary from 105° to 107°; he became delirious; the heart's action was excessively weak, and he died within three days of the commencement of the symptoms. This, however, was evidently an instance of pure septicæmia, and not pyæmia. The post-mortem appearances confirmed this opinion. But cases of this description are rare in comparison with those of acute osteo-myelitis, in which, after well-marked rigors, the patient's condition improves for a time, until another paroxysm of pyrexia occurs, and symptoms of pyæmia become unmistakable. *This* is the moment for an operation; if taken advantage of, amputation affords infinitely the best, and generally the only, chance we have of preserving our patient's life.

We could hardly have a better illustration of this fact than is afforded by the history of a case I well remember, under Sir J. Fayrer's care, in the wards of the Calcutta Medical College Hospital. F. S., a German, aged thirty-four, was admitted into the hospital, having shattered his right hand through the explosion of a gun. Amputation of the right fore-arm was performed within three hours of the accident. He suffered much from constitutional disturbance, and on the thirteenth day after the amputation was seized with rigors. On examination, the ends of the divided bones were found to be denuded of periosteum, and the medulla replaced by purulent *débris;* the arm was therefore re-amputated above the elbow, and everything went well until twenty days after the operation, when rigors again occurred, and acute osteo-myelitis at the end of the humerus was found to exist; the limb was therefore amputated for the third time at the shoulder-joint, after which the patient recovered. In this case pyæmia occurred some days after both amputations through the arm, being ushered in, as it always is, with rigors and consecutive sweats. It was from the occurrence of these symptoms that the existence of acute osteo-myelitis was diagnosed, and the inflamed bone removed before purulent deposits had taken place in the lungs.

From this specimen—one among many—you will understand the necessity that exists in these cases for removing the entire length of a bone affected with osteo-myelitis, in order that the system may be preserved from poisonous infection from the stinking, suppurating medulla. In this instance the condyles of the femur had been excised for disease of the knee-joint, pyæmia supervened, and the ends of the bone having been exposed, its cancellated tissue was discovered to be full of dead and rotting medulla. The surgeon in charge of the case decided to amputate the limb about half way up the thigh, and having divided the bone the contents of the medullary canal seemed to be healthy; but after cutting through the bone and allowing it to soak in glycerine, several small cavities, or abscesses, in the medulla were seen extending from the inflamed lower extremity of the femur up to the point at which amputation was performed, and probably they existed in that portion of the femur which was not removed, acting as a further source of infective matter, for the patient subsequently to the amputation continued to suffer from pyæmia, from which he ultimately died.

Under these circumstances the site at which an amputation is performed materially influences the results of the case. This fact is illustrated by the statistics of the Crimean War. Of 419 cases of amputations in the continuity of bone, no less than 1 death in every 2·5 cases took place; but in 149 amputations through various joints, the death-rate was only 1 in 4·65. M. Jules confirms this statement in favour of disarticulation over amputation through the continuity of bone, for in the Franco-Italian War he disarticulated the limbs of 22 wounded men with uniform success: 4 through the hip-joint, 13 through the shoulder, 1 knee, 3 ankle, 1 wrist.

During the American War, in 39 cases of amputation through the elbow-joint, there were 3 deaths. Of 49 cases of amputation through the knee, 31 recovered; whereas the death-rate after amputation through the lower third of the tibia was 36·19 per cent.

It is evident the danger of amputating through the cancellated tissue of bone must be increased if suppuration already exists in the tissues by which the freshly-opened bone is covered, for the blood sinuses of the medulla must necessarily take up a certain proportion of the infective matter, which is thus introduced into the circulation, too frequently causing pyæmia.

As I have before remarked, however, you are not to suppose that acute osteo-myelitis occurs solely as a consequence of mechanical injuries to the osseous tissue, for the exposure of a limb to extreme cold, such as plunging the legs and feet into ice-cold water, is sometimes followed by acute ostitis; and, as I shall explain to you in the next Lecture, acute epiphysitis is, in most cases, if allowed to run its course, accompanied by osteo-myelitis.

W. S., aged ten, was admitted into the Westminster Hospital, February 8th. The patient's father and mother were strong, well-to-do country people; there was no suspicion of hereditary disease in this case, and our patient, though slim, had been a healthy boy up to the present time. He was perfectly well until December 20th, when, on his way home from school, he fell through the ice into a pool of water, and got his feet and legs wet. In this condition he returned to his cottage. The weather was very cold at the time, and in the evening his legs became extremely painful, and his mother, thinking he had rheumatism, applied hot poultices to his limbs. The patient has since been confined to his bed; his legs became much swollen; after some three weeks two abscesses burst in front of the right shin, and subsequently another formed over the ankle-joint, and discharged a small quantity of matter. The skin inflamed over the left foot in a similar manner. The patient was seen in January, by Mr. T. Eager, of Woking, and, by his direction, removed as soon as practicable to the hospital.

On admission we found that the right leg and foot were pale, swollen, and œdematous, with three ulcers along the shin and over the ankle-joint; there was no discharge from these sores, but on passing a probe through the upper ones, we came down upon soft disintegrated bone; the instrument could be thrust deeply into the dead bone. The left foot was affected in the same way. Our patient was emaciated, with a dull jaundiced eye, dry brown tongue, a small very rapid pulse, and respiration 42 in the minute. His skin was hot and dry, the temperature of his body rising from 103° to 105°.

The patient's leg was disarticulated through the knee-joint on February 5th. He suffered from diarrhœa after the operation, and it was with some difficulty that we managed to control the purging; but, with this exception, he improved rapidly in health and soon left the hospital.

In passing, let me warn you not to think lightly of diarrhœa in cases of pyæmia or to foster the notion that purging of this kind is an effort of Nature to eliminate the poison from the system. My experience leads me to think that the intestinal catarrh with enlargement of the intestinal follicles and mesenteric glands, met with in almost all cases of pyæmia, requires as much care in its treatment as the diarrhœa of enteric fever, and that it must be kept under by means of opium and quinine. I believe that these drugs, but especially the quinine in full doses, are often invaluable in the treatment of pyæmia; we ordered W. S. six grains of quinine and three of Dover's powder, three times a day.

In this case, after exposure to severe cold, the boy complained of deep-seated pain in the lower limbs, followed by inflammation and fever. Had appropriate treatment been then employed, such as rubbing his leg with snow, it is possible the parts might have gradually resumed their normal functions, but the hot poultices in which the boy's limbs were enveloped increased the mischief by augmenting the flow of blood into the superficial vessels, and thus adding to the diseased action already excited in the part. His right leg subsequently became swollen and extremely painful, high fever supervened, pus formed along the limb, and septicæmia too plainly indicated the absorption of putrid matter into the system. The extensive necrosis of the tibia existing on the admission of the patient into the hospital, left us in no doubt as to the nature of the affection we had to deal with.

But I would draw your attention to the condition of the amputated limb. The tibia I show you was taken from this boy's leg immediately after it had been removed from the body, and it has since undergone no maceration or preparation of any kind; you observe its cancellated structure and medullary canal are entirely destroyed. It looks like a bit of worm-eaten wood. The outer shell of bone is much more healthy than any other part of the tibia, and is covered with periosteum, from which in places a considerable quantity of new bone has been produced. All this mischief has been the work of less than seven weeks' disease. On examining the astragalus taken from W. S.'s foot, you notice that, like the lower extremity of the tibia, it is covered with periosteum. Beneath the cartilage of the upper surface of the astragalus is an abscess formed in the cancellated tissues of the bone, the pus it contained having found its way into the ankle-joint. A similar collection of matter has formed in the head of the bone and burst into the astragalo-scaphoid articulation. But I would call your special attention to the deep red patch of cancellated tissue beneath the cartilage lining the lower surface of the bone; you notice that it is surrounded by apparently healthy osseous tissue, the patch itself being a spot of acutely inflamed bone. I have examined sections of the part under the microscope, and it affords us a good example of the earliest stage of the process, which, after continuing for a time, has led to the abscesses above referred to in this astragalus, and which has reduced the tibia to the necrosed condition in which you now see it.

As a consequence of the increased action going on in this inflamed patch of bone, which is in immediate proximity to the cartilage, we find that rapid proliferation has taken place in the nuclei of the neighbouring cartilage-cells, but, in addition to this, you may notice that a considerable number of these subdivisions of the nucleus are surrounded by a rather thick layer of granular matter, and this again is enclosed in a case of earthy or inorganic material. I conclude, therefore, that in consequence of the increased action going on in the part, the protoplasm of the cartilage-cells has grown rapidly, and secreted a quantity of earthy matter from the blood, and thus built up an irregular mass of lowly-organized osseous tissue, not very unlike that which lines the extremity of the long bones (p. 17).

In other parts of this specimen we see that a number of the cartilage-cells, or rather their descendants, have united, and blood-vessels having perforated into this conglomeration of nuclei a patch of medullary tissue has been formed in the substance of the cartilage. Some of this cell-growth reaches forward to the free surface of the articular cartilage, forming what is usually described as an ulcer.

In this specimen, therefore, we have clear evidence of the fact that acute ostitis (or, as I prefer to call it, osteo-myelitis) may lead to the ulceration of the articular cartilages, and that, the cartilage having been perforated in this way, a sinus passes through it, leading very probably into the medullary spaces in the spongy portion of the affected bone.

With reference to the inflamed bone, the most obvious pathological alteration we notice in the specimen now under observation is, that the vessels contained in the medulla are engorged with blood, and that the fatty matter contained in the medullary spaces is diminished in quantity, the myeloid cells of the medulla are increased in number, almost entirely occupying many of the medullary spaces; and doubtless, unless the inflammatory process were excessive in its action, it is from these cells that new bone would have been produced, the layer of newly-formed osseous tissue acting as a protective influence against the absorption of the products of inflammation into the system, in the same way as the walls of an abscess preserve the circulating fluid from the passage of pus into the blood. But in the instance now under consideration, the disease being acute, the cells of the medulla have exceedingly multiplied in consequence of the excessive action going on in the part, but they have not had fair play; surrounding circumstances have choked their growth, and here we see them crowding and pressing on one another. In addition to these cells the medullary spaces contain a large quantity of free granular organic matter.

I am aware that it is a disputed point as to the part which the bone-cells of the lacunæ take in the process of ostitis, but from this specimen you will see that many of the canaliculi leading from the inflamed medullary spaces to the lacunæ are enlarged, most of the lacunæ are three or four times their natural size, and filled with granular matter; in fact, they are in the same condition as the cartilage-cells—a circumstance to be expected, considering that they are simply cartilage-cells encased in earthy matter.

The normal function of the living matter contained in the bone-corpuscle is impaired, and you must bear in mind the fact that the osseous structure immediately round one of these corpuscles is repaired and kept in its healthy state through the action of the living bone-cell. Destroy this nucleus, or let its functions be perverted by abnormal surrounding conditions, and the area of bone depending upon it dies, a cavity being formed round the bone-corpuscle, which, in the case we are now considering, is occupied by rapidly-growing protoplasm.

Under the influence of the inflammatory process one bone-corpuscle after another is destroyed, the spaces they occupied run into one another, and a cavity occurs in the trabecula, which ultimately opens directly into the nearest medullary space. The form this cavity takes is that of the original growth of the lacunar system, being thus more or less circular in figure, producing the appearance commonly known as Howship's lacunæ.

It is evident, therefore, that the osseous framework of bone plays but a small part in cases of acute osteo-myelitis, and, in fact, almost the whole of the soft structures contained in one of the long bones may be destroyed and the patient killed from the effects of septic poisoning; and yet we might examine sections of the dry bone under the microscope, and be unable to discover that the Haversian system had been in any way implicated, illustrating a point I have so often dwelt upon, that the study of pathology is apt to mislead us unless we examine specimens of diseased structure implicated immediately after death, and alter their condition as little as possible by chemical reagents.

Several English authorities have advocated the idea that the disintegration of bone in cases of inflammation and other abnormal conditions, is mainly due to the formation of lactic or some other acid in the part, which, by chemically acting on the bone, causes the eroded, worm-eaten appearance we so frequently see in dead bone removed from the living body. It is not possible to imagine that there is a sufficient supply of lactic acid in the human body to effect this object; and the mineral acids would hardly act on the organic matter otherwise than to soften it, by dissolving away the inorganic materials contained in the bone. It is possible that carbonic acid might remove both the organic and inorganic constituents of dead bone, or of ivory pegs driven into the bone. I cannot help thinking, however, that the worm-eaten condition of dead bone is due, like that of rotten wood, to decay; and that if it were possible to examine the part, we should discover that for every cavity in ivory pegs driven into living bone, we should find that a growing process of medulla had protruded into the ivory, as the roots of a plant into an old wall.

Nor do we require the help of a chemical theory of this description to explain the phenomena I have noticed, for if the healthy function of the nucleus or living portion of the cell is destroyed, evidently the parts around, which depend upon it, being no longer repaired, a cavity must result in the osseous structure, such as I have described. In ordinary language, if the source from which a stream has been fed becomes dried up, we hardly talk about the river having become absorbed; and so in the matter of the cartilage and bone-cells, if the living material from which the parts are produced ceases to be, evidently an empty space occurs around the site of the original cells, which cavity, as in the instance now under consideration, may speedily be filled up by extraneous matter.

But you may naturally remark, "Well, you have told us much about septicæmia, pyæmia, and the changes effected by acute osteo-myelitis on the bones, but very little about the treatment of this formidable class of cases, unless by amputation of the affected limb." In answer to this, I would observe that it seems to me that the best way to put you right in a matter of the kind, is to explain the nature and cause of the symptoms of the disease you have to deal with. If you thoroughly understand these matters, and so make no mistake in your diagnosis, or misunderstand the pathology of osteo-myelitis, its treatment really comes to be almost a matter of common sense. Much must depend on the age of your patient, his circumstances, and the stage to which the disease has advanced. But, as I have already stated, a person suffering under the influence of *pyæmia*, supposing the septic poisoning is derived from an acutely inflamed bone, will almost certainly die unless you remove the whole of the affected bone. This being my firm conviction, it is useless discussing any other mode of treatment.

Supposing, however, your patient is suffering from *septicæmia*, the result of acute osteo-myelitis or periostitis, unless the disease be of such a deadly form as I have referred to at page 36, it is possible that he may recover without amputation, and in the course of time the dead may be removed from the living bone without sacrificing the limb.

Extreme depression of the nervous system, the effect of septic poisoning, is, perhaps, best overcome by champagne, administered every hour, with a small quantity of brandy in it, together with beef tea, milk, Brand's essence of meat, and so on. The distressing sleeplessness from which most patients suffer when labouring under the effects of septicæmia may be relieved by a draught containing twenty grains of chloral hydras and twenty grains of bromide of potassium, given at bedtime; but I do not think that repeated small doses of these drugs are serviceable in cases such as those we have been considering.

The effects of a subcutaneous injection of pilocarpine were very remarkable in the instance of a patient of mine suffering from septo-pyæmia, and although the patient died, in similar cases I should certainly administer this drug.

From an abstract of this case, made for me by my dresser, Mr. J. P. Batterham, it appears that J. A., aged forty-six, was admitted into the Luke ward on September 4th. The man's previous health had been good, and he appears to have been a temperate, hard-working fellow. Some eight weeks ago he was knocked down, and his left leg injured; it was uncertain if his fibula had been fractured. There was no external wound, but the night after the accident his leg became very painful and swollen; he was unable to resume his work for fourteen days, and even then the leg was so painful he could only limp about on it. When admitted into hospital there was evidently a collection of matter beneath the skin of the lower and outer part of his left leg; his temperature was 105·6°; he had intense headache, and was delirious during the night. There was no albumen in his urine.

On the following day fluctuation could be detected over the lower and outer part of his left leg; the matter contained in this abscess, together with the one over the site of the original injury, was evacuated under the carbolic spray. The patient's temperature varied from 102° to 106°; his heart's action was very depressed; he had serous diarrhœa; there was no albumen in his urine. On the 6th a third abscess formed over the lower part of the right leg, and both knee-joints were distended with fluid; at the same time the bases of his lungs were affected with pneumonia, and the urine contained albumen. The patient was fed with beef tea and brandy, quinine was administered, also the hydrate of chloral and bromide of potassium at bedtime. On the following day the patient's left elbow-joint was full of fluid, another large abscess had formed beneath his left clavicle, and the surface of his body was covered with a rubeoloid eruption; his temperature varied from 104° to 107°. The patient remained in a condition of low muttering delirium, and the heart's action was extremely feeble. It was evident he was dying from septic poisoning; and with the idea of relieving the system through the skin, by the advice of Dr. Murrell, half a grain of pilocarpine was injected beneath the skin of the patient's arm. The effect of this was truly surprising; in the course of ten minutes the patient was in a profuse perspiration, his tongue became moist, he asked for food, and began to talk to those around him; his temperature fell to 103°.

On the following morning the patient was again delirious, and in a very precarious condition of nerve weakness. The pilocarpine was again injected, with a result very similar to that above described, the improvement in the patient's condition lasting until the evening, when he died somewhat suddenly.

After death a clot was found filling the right side of the heart, and extending into the pulmonary vessels, and the other post-mortem appearances rendered it quite certain that the patient died from the effects of septo-pyæmia.

In the less severe instances of septicæmia, ten grains of quinine administered every four hours, until it produces its characteristic effects of singing in the ears and so on, is, no doubt, a valuable remedy, reducing the fever, and otherwise favourably affecting the condition of the patient.

Supposing a person is suffering from septo-pyæmia, accompanied with great nerve depression, it is not advisable to amputate, or to perform any other operation, until the condition of his nervous system has been somewhat improved by means of stimulants, quinine, and food. If the patient is so deeply under the septic poison as to be incapable of rallying by treatment of this kind, it is not likely that he would survive the shock attending an amputation. On the other hand, if there is no clear evidence of pyæmia, it is quite possible that, by means of a stimulating plan ot treatment, we may be enabled, if necessary, to perform a serious operation with success, or that our patient will respond to treatment so readily that we may not consider it necessary to remove the affected member. I need hardly remark that collections of matter, wherever situated, if giving rise to septic toxæmia, should not only be evacuated as speedily as possible under the carbolic spray, but that the greatest care must be taken to prevent, if possible, the re-accumulation of pus in the part.

CHRONIC ABSCESS OF BONE.

Circumscribed abscesses in the cancellated structure of bone were first described by the late Sir B. Brodie. He relates the history of a young man, who consulted him in the year 1824 on account of considerable enlargement of the lower end of the right tibia; the ankle-joint was apparently sound, but the skin was tense and adherent to the periosteum. There was constant pain in the part, sometimes very severe, which had been going on for twelve years. Treatment having failed to give relief, the limb was amputated, when the enlarged lower extremity of the tibia was found to contain an abscess about as large as a chestnut. This preparation is in the museum of St. George's Hospital. I can hardly think, however, Sir B. Brodie was right in supposing that if this abscess had been opened by means of the trephine the disease would have been cured, for the dense sclerosed bone surrounding the cavity would, I think, have remained a constant source of irritation and pain to the patient. So firm is my conviction on the subject, that, as the details of the following case illustrate, I lately removed the leg of a patient in a somewhat similar condition to that above described.

T. S., aged thirty-five. This man was sent up from Dartford by Mr. Edwards, who informed us that more than one of the family had died of phthisis. When a boy, T. S. injured the lower part of his left leg, and from that time the leg has been a constant source of trouble to him; occasionally he has been free from pain for months together, and then without any assignable cause his leg has become swollen and very painful.

On admission into hospital the patient had anchylosis of the left ankle-joint, the inferior extremity of his tibia being greatly enlarged. T. S. was otherwise in good health, but had been unable for some time past to follow his vocation as an engineer, in consequence of the pain which he suffered in the diseased bone. The skin over the fore-part of the left leg was ulcerated from the effects of escharotics, which had been employed in the hope of relieving the symptoms from which he suffered. No sinuses existed, nor could I discover evidence of necrosed bone. I bored into the diseased end of the tibia with a hand-drill, and some dark sanious pus welled up from a cavity into which the instrument passed, near the centre of the lower third of the bone. This operation relieved the symptoms for a time, but the pain returned as severe as ever as soon as the patient commenced to move about; and as I felt that no amount of drilling the bone would remove the dense sclerosed tissue which surrounded the cavity in its centre, and as the patient was most anxious that the leg should be amputated, the limb was removed: the patient speedily recovered from the operation. On cutting a section through the diseased bones, the os calcis is found to be inseparably united to the tibia. In the centre of the lower third of this bone a cavity two inches long is to be seen; this cavity is lined with a dark soft tissue, and did not contain any dead bone; it is surrounded by a mass of extremely dense bone. In this case it appears that a chronic abscess had existed in the lower end of the patient's tibia for years, and the sclerosed osseous structures surrounding it had gradually been produced by the constant irritation going on in the part.

We have here another specimen of a circumscribed abscess which occupied the centre of the os calcis, a position rather common for disease of this kind. Dr. C. T. Poore, of New York, describes no less than three somewhat similar instances of affections of the os calcis in the *Medical Record* for November, 1879.

H. T. was sent into the hospital by my friend Dr. Ferris, of Uxbridge, on March 2nd. Some four years ago, after having taken an unusually long walk, he was seized during the evening with violent deep-seated pain in his right heel. His impression at the time was that he had sprained his foot, but however this may have been, he suffered from more or less pain, which always increased towards night. His foot was swollen, and he could not bear the slightest pressure upon the heel.

After being confined to his room for some months, these symptoms gradually subsided, but the pain soon returned, and he continued to suffer more or less for upwards of twelve months, when an abscess burst on the inner and under part of his foot, and gave exit to some matter. This seems to have relieved the pain, but the discharge has since continued both from the original and fresh sinuses which have formed on the inner side of the heel.

H. T. came under my treatment after suffering in this way for four years. He was then unable to put his right heel to the ground; the soft structures covering it were swollen, and there was a constant discharge from various sinuses on the inner side of his foot. On passing a probe down upon the os calcis I could not discover any bare bone. Under these circumstances I made an exploratory incision into the soft parts, and found a small opening through the lower surface of the bone leading to a cavity in the centre of its cancellated tissue, and I therefore removed the whole of the os calcis subperiosteally, with the exception of a thin slice along its upper and anterior articular surfaces. From the time of the operation H. T.'s health improved; the sinuses healed, and new bone has partly replaced that which I removed, so that he has resumed his occupation, and does not even require the aid of a high-heeled boot to enable him to walk.

You observe that the cavity in this os calcis does not contain any dead bone, and further, its walls are formed of a compact layer of osseous structure, lined with a soft secreting membrane, corresponding to the walls of a chronic abscess of the soft parts of the body. This layer of compact bone is dense (sclerosed), so much so as to be of ivory hardness, formed not only by bone produced from the surrounding medulla, but a portion of the walls of the abscess is lined by a thin lamina of hard bone, produced from an ingrowth of the periosteum into the cavity; its lacunæ and canaliculi run parallel to the free surface of the membrane, as they do beneath the periosteum of the shaft of one of the long bones. But if, in place of opening externally, as the collection of matter had done in this case, the abscess had been so situated that the direction of least resistance for the pus to have taken had been into a joint, the result would have been to excite changes in the part, ending, in all probability, in the destruction of the articulation. And this is doubtless the history of some cases of joint disease; or, in other words, chronic ostitis, though by no means always ending in abscess, may terminate in partial disintegration of the bone, and destruction of a neighbouring joint. As an instance in point, I may refer to the notes of the following case:—

J. P., aged forty. Fifteen years ago, this patient first began to complain of pain in the right knee. There was no history of injury; he was laid up at this time for two years with intense pain and inflammation near or in the joint. Subsequently he was able to move about, but still there was frequent recurrence of deep-seated pain in the lower end of the femur.

On admission, the parts covering the knee-joint were natural in colour, but swollen; there was no excess of fluid in the joint, or indication of its being diseased, but the condyles of the thigh-bone were greatly enlarged; there were no sinuses, abscesses, or other indications of necrosed bone in the part. As the patient had suffered for so long and so constantly from pain in the limb, he begged that it might be amputated.

After removal, the lower end of the femur was found to be greatly enlarged, and in the centre of its cancellated tissue there was a cavity as big as a bantam's egg, surrounded by intensely hard and sclerosed bone. From this cavity, which had doubtless been the site of an abscess (such as we see in H. T.'s os calcis), a narrow passage opened into the knee-joint. The outer layers of the shaft of the femur had almost disappeared, and a large quantity of new bone had formed from the periosteum.

In this case, therefore, there is evidence that an abscess had existed in the lower end of the femur and opened into the knee-joint; the sclerosed bone enclosing the abscess was the result of the long-continued inflammation that had occurred in this locality, and this dense hard shell of bone had been a disturbing element in the nutrition of the part for years, keeping up hyperæmia and the protracted pain from which the patient had suffered.

Mr. Carr Jackson has given the details of more than one successful case in which he perforated the bone for the relief of an abscess in its interior. In the majority of his cases, and those recorded by other surgeons, symptoms of the disease commenced before the patient had reached the adult period of life, and the collection of matter formed either at the upper or lower extremities of one of the long bones. It is well to bear this fact in mind in connection with the liability which the soft structures at the line of junction between the diaphysis and the epiphysis of the growing bone have to become inflamed.

In one of Mr. Jackson's cases, the patient was a girl, sixteen years of age. For seven years before coming under his care the patient had suffered from constant and severe pain in the upper extremity of her right tibia and knee. No disease of the joint, however, could be detected; but a circumscribed swelling existed over the upper and anterior part of the bone, which was very painful on pressure; but otherwise there was no enlargement of the bone. The integument over this swelling having been divided, the bone was trephined to the depth of an inch, and then a gouge was thrust into a cavity, from which two or three drachms of pus escaped. The patient gradually recovered, and left the hospital perfectly cured.

We may contrast the outlines of the above case with one we have lately had in the Luke ward, showing the difficulty which exists in diagnosing chronic abscesses of bone.

C. P., aged twenty-eight. His family history is a good one; there is no evidence of his being the subject of any hereditary or acquired disease. The patient states that some three years ago he received a blow over the upper part of his right leg, which was followed by pain in the bone; the pain gradually increased and became of a deep gnawing character, and has now become so severe as to entirely prevent him from following his occupation.

On admission into hospital, C. P. was suffering from most intense pain in the upper part of the tibia and right knee-joint. The agony which he endured at night was intense. We found no evidence of disease of the knee, but on the inner side of the head of the tibia the bone was slightly enlarged; there was severe pain on pressure over this spot; the skin covering it was healthy. Full doses of iodide of potassium, together with morphia injections, were employed without any relief to the symptoms. On March 15th the tibia was transfixed from within outwards, through the painful spot, by a large-sized hand-drill; no pus escaped from the wound. The operation was followed by relief from pain, and the local temperature of the part, which had always been somewhat higher than that of the corresponding spot in the other limb, fell to its normal degree.

This improvement, however, did not continue; the pain returned as severe as before, and on March 29th I passed the drill through another portion of the head of the bone, but discovered no pus.

Temporary relief also followed this operation, but the pain soon returned, and the patient subsequently left the hospital without benefit.

It is probable, in this case, that suppuration had not occurred within the head of the bone, but that it was an instance of that form of disease which has been described as neuralgia of bone. The symptoms, however, from which the patient suffered were very similar to those described by Sir B. Brodie and other authorities, as characteristic of chronic abscess of bone. There was slight enlargement over the upper end of the tibia, paroxysms of intense pain increased by pressure, and starting from the tender point on the inner side of the head of the tibia; the pain remitted, but recurred with increased severity at variable intervals; nevertheless, there was no abscess in the head of the tibia.

You will observe how little inconvenience followed the two operations performed on the bone in this case—an important point to bear in mind, because it is almost impossible accurately to determine, in any given case, if an abscess exists in the cancellated tissue of a bone, unless we have actual evidence of the presence of pus in the part. With a combination of symptoms such as those to which I have referred, we were justified in opening the bone by means of a hand-drill. There is much the same difficulty in diagnosing the presence of matter which may be deep-seated in other parts of the body, and we know how invaluable the grooved needle, or the aspirator is under these circumstances; and so it is with abscesses of the bone. The hand-drill may evidently be employed in suspected cases of the kind, not only for the relief of the symptoms, but as a means to enable us to arrive at an accurate diagnosis regarding the nature of the case. The importance of forming a correct opinion in instances of the kind is demonstrated by the history of two of the cases above referred to. In that of T. S., the abscess which formed in the lower end of the tibia had opened into the ankle, and led to disease ending in the complete fusion of the bones constituting the joint, a condition which made it all the more necessary for us to amputate the leg. In the instance of J. P. the same tendency was observed for an abscess in the cancellated tissue of the bone to open into a neighbouring joint, this preparation showing the passage by which pus had passed from an abscess in the end of the femur into the knee-joint.

If an abscess has formed in the bone at some distance from the joint, the pus may find its way externally, and discharge itself through the skin, as in the instance of H. T., page 54.

With reference to the treatment of cases of chronic abscess of bone, having determined the existence of a collection of pus, our object must evidently be to give exit to the matter by means of a hand-drill, or some such instrument, which will effectually open the cavity. Operations of this description have become less dangerous, and the patient's recovery more speedy, since the introduction of antiseptic means of treatment, and the employment of Esmarch's bandage, which prevents any bleeding during the time of the operation. But if an abscess, or, in other words, chronic osteo-myelitis, has existed in the bone for a considerable time, the osseous tissue surrounding it necessarily becomes sclerosed, and a thick shell of bone is produced, by means of which the medulla is prevented from reaching the cavity of the abscess, and so no new bone is formed in it. Under these circumstances we may, in instances of disease affecting the bone, such as the os calcis, remove the sclerosed osseous tissue, together with the abscess, subperiosteally. In other cases we must not only open the abscess but also destroy the sclerosed bone that surrounds it, so as to allow the medulla to grow into the cavity.

With reference to these cases, however, I may repeat the well-known maxim, to diagnose the disease before you attempt to treat it. Under any circumstances, in the majority of instances, it is well to administer a course of iodide of potassium in full doses before resorting to an operation. This drug and counter-irritation failing to relieve, we are justified, if the symptoms are very severe, so that relief in some way is demanded, in puncturing the bone by means of a hand-drill. Neglect of this practice not only leads to protracted suffering on the part of the patient, but ultimately to the amputation of a limb, which might possibly have been saved.

LECTURE III.

ACUTE EPIPHYSITIS AND SUPPURATIVE PERIOSTITIS.

SUPPURATIVE periostitis is described by the majority of English surgeons as being an affection of early life; but the question is, why acute inflammation of the periosteum should be a more common and serious disease among children than it is in adults.

In the first place, I wish to direct your attention to the following history, illustrating the symptoms and course usually run by acute inflammation, leading to suppuration of the periosteum in an adult, non-syphilitic patient.

E. G., aged twenty-four, was admitted into the hospital on December 14th. She was a strong, healthy girl, and had always enjoyed excellent health. There was no evidence of syphilis, either hereditary or acquired, in her case. The patient's family history was good. She had never suffered from rheumatism, and attributes the affection of the leg from which she now complains to a blow she received on her left shin ten days before coming into hospital. Subsequently to the accident, an extremely painful swelling formed over the upper and inner surface of her left tibia. The pain became so violent at night that she could not sleep, and being unable to perform her duties as housemaid, she was sent into hospital. On admission, a circumscribed, tense, oval, brawny swelling was found in the situation above mentioned; it was three inches long, and an inch and a half wide at its broadest part; the skin over the swelling was of its natural colour; the patient was feverish, and described the pain in her leg as being very great. The day after admission I passed a grooved needle into the abscess; the point of the instrument impinged on bare bone, and it was evident that the base of the inflamed structures was formed by a portion of the denuded tibia. Pus escaped along the needle, and in this way I pressed out the fluid contents of the swelling, and then removed the instrument, and placed a firm compress over the part. She soon recovered, and left the hospital cured.

The symptoms caused by the form of periostitis we are considering are, great local pain especially at night, a rise of temperature over the part, general feverishness, and sometimes rigors. The pain is much increased on pressure being applied, and usually by the heat of the bed-clothes; a circumscribed swelling appears, with its base formed by denuded bone; suppuration speedily occurs, and if the disease is allowed to run its course, the matter bursts through the skin, and in some cases superficial necrosis or caries of that portion of the bone which has been stripped of its periosteum follows. On the other hand, if the disease be carefully treated from the first, the extract of belladonna being freely applied over the inflamed area, and the limb kept perfectly at rest, it is probable that the parts will soon resume their healthy functions.

If in doubt in a case of this kind as to whether suppuration has occurred or not, do not hesitate to run a grooved needle into the swollen tissues; the escape of serum from the part along the instrument, even if no matter has formed, will relieve tension, and so assist in subduing abnormal action going on in the inflamed periosteum.

I have seldom seen a case of periostitis in a non-syphilitic adult lead to more serious results than those I have mentioned, although the attack, as in this instance, was acute, terminating in suppuration within seven days of its commencement. I shall revert to the subject of nodes when lecturing on syphilitic diseases of bone; but it is well known that periostitis occurring in connection with syphilis has a tendency either to disappear, or to lead to permanent periosteal thickening. Nodes, however, occasionally suppurate, and are then, perhaps, followed by ulceration of the soft structures and caries of bone; so that whether acute periostitis, in an adult, arises from syphilis, or any other cause, its effects are, for the most part, local; but the periostitis of early life not only frequently leads to the rapid destruction of one or more of the long bones, but too often terminates in fatal septo-pyæmia. I cannot help thinking that the explanation of these phenomena depends on the difference that exists between the anatomy of a growing and that of a fully-developed bone, and that the majority of cases of "suppurative periostitis" occurring before the adult period of life, are instances of disease which has commenced in the structures situated between the diaphysis and epiphysis of the bone, spreading from thence not only to the periosteum, but also to the medullary tissues contained within the bone. We cannot always demonstrate this fact, because, fortunately, not a few of our patients get well, and so fail to allow us to complete our pathological studies as to the nature of the disease from which they suffered. The following is an example of the class of cases commonly described as acute suppurative periostitis of early life.

W. C., aged six, was admitted into the hospital on December 21st. He stated that he received an injury from a blow across the upper part of his right leg. The limb subsequently became swollen and painful. The patient was a pale, sickly-looking little fellow. On admission he had high fever; we found his right leg was greatly swollen and of brawny hardness; his sufferings were intense. On the 23rd, a deep incision being made down to the bone, a considerable quantity of pus escaped from the wound. On the 27th another incision was made along the lower part of the fibula so as to give exit to matter. The shaft of the bone was found to be denuded of periosteum almost throughout its entire length, the abscess extending upwards to the head of the fibula. As the discharge became very profuse and the child's health was rapidly failing from septicæmia, I cut down on the bone and removed the whole of the shaft, leaving the upper and lower epiphyses and so much of the periosteum as had not been destroyed by inflammation.

In this instance, at first sight, the case looked like one of abscess originating among the muscles of the calf of the leg; but on passing a grooved needle into the muscles no pus could be discovered, and we had to cut down upon the upper extremity of the bone before the matter flowed into the wound. Free incisions were therefore made through the periosteum; subsequently the shaft of the fibula was removed, leaving, however, the upper and lower epiphyses. The greater part of the bone has re-formed from the epiphyses and the remains of the periosteum of the shaft. You can now distinctly trace the outlines of a new fibula under the cicatrix in the skin; in fact, the shaft of the bone has been partially re-formed.

If you examine the bone removed from W. C.'s leg, you notice that it is denuded of periosteum; its lacunæ, in the external layers of the bone, are large, irregular, and broken down—in fact, the protoplasm they contained having ceased to live in consequence of inflammation of the periosteum; and so the outer layers of the bone died, but the contents of its medullary canal and the soft tissues in the interior of the fibula are also in a state of inflammation, though far less affected than in the case of acute osteo-myelitis I referred to in my last Lecture.

The explanation of these changes is very simple.

The outer laminæ of the long bones grow from, and receive their blood-supply through, the periosteum; this covering of the bone having been destroyed by inflammation during life, the layers of osseous tissue depending upon it died; in the same way, and for similar reasons, a portion of the internal structure of the fibula has perished in consequence of the acute osteo-myelitis by which it was attacked.

In the case of W. C., we cannot determine in what part of the bone the disease commenced, for the patient recovered; but it is certain, although the shaft of his fibula was denuded of its periosteum and its outer layers were necrosed, that the upper and lower epiphyses of the bone lived, and grew rapidly subsequent to the removal of the shaft. If you contrast the features of this case with that of the first one I related to you, you cannot fail to observe the difference between the symptoms and the result produced by an instance of acute periostitis occurring in an adult as contrasted with suppurative periostitis of childhood. In the case of this boy, and in all similar instances of disease I have seen among young persons, high fever and alarming symptoms of septicæmia have been marked features of the disease, combined with the formation of matter along the shaft of the bone, and subsequently into the surrounding soft parts. Symptoms of blood-poisoning have not unfrequently manifested themselves during its early stages, and sometimes before the soft tissues have given way so as to allow the external air access to the inflamed tissues.

When speaking of the development of bone, I mentioned that the line of junction between the diaphysis and epiphysis in the young subject is not only freely supplied with blood, but that at this line active changes are going on in the neighbouring cartilage-cells, and, as I further explained, the deeper layers of the periosteum have an intimate connection with the epiphyses. That abnormal changes are likely to occur in the soft tissues between the diaphysis and epiphysis, as a result of injury or other causes, seems likely enough, and if inflammation were established at this line, it is equally clear, from the anatomical arrangement above referred to, that it would be liable to extend to the periosteum and the shaft of the bone from the epiphysis. If this be the true explanation of these cases, it is evident that they can only occur among children, or, at any rate, previously to the time when the diaphyses and the epiphyses of the various bones become continuous with one another. The question is, how far do facts support this idea.

S. S., aged three weeks, was admitted into Queen Anne's ward on June 10th. The child's mother was a strong, healthy woman, and had two other children, both living. Our little patient had been exclusively fed from the mother's breast, and appeared to be a well-nourished infant, with no marks of syphilis or any other disease about her. Five days before bringing the child to the hospital, Mrs. S. observed that her infant's left knee had become much inflamed. She could assign no cause for this state of things. The swelling of the limb increased rapidly, and within four days matter formed and burst externally at the inner and lower end of the thigh. On admission the left knee and the parts above and below it were intensely inflamed; pus was discharging from the wound close to the knee, and a probe inserted through this opening could be passed into a cavity extending across the lower part of the femur, in which bare bone was felt, and, the case at first was supposed to be one of acute arthritis of the left knee-joint, and entered as such on the patient's admission ticket. A counter opening was made along the other side of the limb, so that free drainage was established. Cold applications were employed, and the limb kept at rest on a splint. There was no evidence of suppuration in connection with any other epiphysis of the body. On the following day I found the little patient evidently sinking rapidly, and she died within thirty-six hours of my visit to the hospital.

On a post-mortem examination we discovered that there was no disease of the left knee-joint; the ligaments and other structures entering into the formation of this articulation were intact. But the lower epiphysis of the left femur was separated from the shaft of the bone by a cavity filled with pus. The lower half of the bone was completely denuded of periosteum; the medullary structure of the diaphysis was intensely inflamed; the lower end of the bone, in fact, affording us a well-marked illustration of the effects produced on the osseous structures by acute osteo-myelitis, the periosteum also being extensively involved in the disease.

If we consider the condition of the tissues I have described as a whole, we can hardly doubt that from some unknown cause suppurative inflammation had been established in the medullary structures at the line of ossification between the diaphysis and the epiphysis of the femur, and that the intensely inflamed condition of the lower part of this infant's thigh had commenced in the disease between the diaphysis and the epiphysis of the lower end of the bone. The condition of the limb, and the fact stated by our house-surgeon that a probe inserted through the opening in the skin in its course touched bare bone both above and below the instrument, enabled me when first I saw the child, to point out to the class the nature of the disease, and to explain the reason of the dangerous condition the patient was in, being, as she then was, well-nigh in a state of collapse from the effects of septicæmia. Evidently, if the disease had commenced in the knee and run on to suppuration, a probe passed through the joint would not have impinged throughout its course on bare bone, because the articulation in so young an infant as this is constituted of the soft cartilaginous epiphysis of the femur and tibia, and not of bone.

The following is another instance of the same kind, and you will observe from the notes that this patient was taken into the hospital as a case of "acute rheumatism." Symptoms of pyæmia were speedily established in a marked degree, accompanied by local inflammation and suppuration within various synovial membranes. This was, in fact, a case of acute epiphysitis, followed by death from pyæmia.

M. A. D., aged ten, admitted into the hospital on January 25th. The following notes of her case were kindly kept for me by my dresser, Mr. Gubbins. The child's mother states that ten days ago the patient came from school saying she had fallen and hurt her left foot. She limped from this time, but until January 22nd was able to move about. She was then, while seated in her chair, seized with a violent fit of shivering. She was put to bed. The shivering lasted for an hour or so, and recurred again in the evening. During the night the child became delirious. On the 23rd she was taken to the surgical out-patient department and ordered into the hospital. She was admitted into the medical wards on the 25th as a case of acute rheumatism. On the following day I was requested to see the child in consequence of the inflamed state of her left ankle-joint. I found the patient huddled up in bed with her knees and thighs flexed; she had the piercing scream of a child suffering from meningitis; her pupils were contracted, her features drawn, almost convulsed, and she could not bear the light. The slightest effort to move any of her limbs greatly increased her agony. There were numerous small hæmorrhagic vesicles over the skin, covering her chest and abdomen. Her temperature varied from 103° to 105°. Her lungs were seriously implicated.

On examining the left ankle, I found a swollen condition of the soft structure over the outer malleolus, extending upwards some two inches along the shaft of the bone. On passing a grooved needle into the part, pus exuded along the instrument, and I therefore made a free incision down to the bone, which was bare of periosteum, and the epiphysis necrosed and separated from the diaphysis. The patient's constant piercing cry was so distressing that she was removed to a special ward. But in spite of careful nursing and treatment she died within a few days.

On making a post-mortem examination, Mr. Neale found the left fibula necrosed and denuded of periosteum for some two inches from its inferior extremity; the lower epiphysis was separated from the shaft of the bone, and on section its cancellated tissue was inflamed, with a number of small abscesses extending from the diaphysis upwards along the interior of the shaft of the bone. On opening the right and left hip-joints, the left shoulder, right sterno-clavicular, and the metacarpo-phalangeal joint of the left little finger, the synovial membranes were distended with pus; the other joints were not opened. On examining the brain, it was hard to say in what respect it differed in appearance, over its upper surface, from that of a child who had died from meningitis; the deep injection of the membranes and extravasations into the cortical substance of the brain were very marked. In the lungs numerous foci of suppuration were observed, and similar infarctions were found in the lining membrane of the right side of the heart.

In this case, from the symptoms during life and the post-mortem appearances, we have clear evidence of septo-pyæmia, and these symptoms commenced before air had gained access to the seat of primary lesion, which, it appears to me, we may fairly assume was an injury to the lower extremity of the left fibula, followed by suppuration of the medulla, contained within the shaft of the bone, as well as the periosteum, and the absorption of matter from these inflamed tissues into the circulating fluid. It is impossible to determine if the lower epiphysis of the fibula had at the time of the accident been broken from the diaphysis, but there can be no question as to suppuration having occurred in this locality, and of the existence of acute osteomyelitis and periostitis in the end of the bone. All that followed was, I think, consequent on this local inflammation, and the history of this case gives us a clue to the reason why suppurative periostitis in early life is so fatal a disease. The truth seems to me, as I have before stated, that the soft growing and vascular tissues at the extremity of the diaphysis are in these cases primarily inflamed; the medulla in the cancellated tissue of the bone, in many instances, becomes speedily implicated, and this, I suppose, is the main channel through which septic poison enters the circulation, though it may be that the absorption of rotten albuminoid matter occurs also from the vessels external to the bone.

As an instance in point, you should study the case recorded in Appendix A., at the end of this volume. The details of this most instructive case are too voluminous for me to read over to you on the present occasion; nevertheless, it is difficult, without destroying their value, to abridge the notes so carefully kept for me by Mr. Mortimer. The case seems to demonstrate that septicæmia may run a protracted and dangerous course, depending on acute inflammation of the bone, independently of pyæmia, or of an open wound. That "acute periostitis" is, in truth, as much an affection of the medulla as it is of the outer covering of the bone; but this fact can only be demonstrated by making sections through the shaft of the affected bone immediately after its removal from the body. That patience and careful treatment, based on sound principles regarding the pathology of the disease, are at times eminently successful in this very dangerous class of cases, provided the patient suffers from septicæmia, and not from pyæmia, which is almost always a fatal complication.

Acute epiphysitis, although most frequently met with among children under two years of age, is not by any means confined to infant life, as we have seen from the cases already detailed, and the following history confirms this fact.

W. Y., aged fourteen, was sent into the hospital suffering from acute inflammation of the shoulder-joint. In this case the lad's parents were country people, residing in Oxfordshire; his brothers and sisters (five in number) "were never ailing." Fourteen days before W. Y. came under my care, his left shoulder became excessively painful and inflamed; matter formed, and an abscess opened half-way down the arm. On admission, we found the soft parts covering the patient's shoulder and upper parts of his arm were brawny and greatly swollen; a profuse discharge of pus poured away through various openings in the skin. The boy was jaundiced, he had a dry tongue, was delirious at night, had a very high temperature, profuse perspirations, and diarrhœa; in fact, he was in the last stage of septicæmia. On passing a finger up the sinuses towards the head of the humerus, I found the epiphysis was separated from the diaphysis, and that the bone was bare of periosteum for some distance below its upper extremity. As you see from this specimen, the upper epiphysis in this instance is detached from the diaphysis, the medullary structure of the latter being in a state of suppuration, but the cartilages of the glenoid cavity and head of the humerus are unaffected.

The disease in this case probably commenced between the diaphysis and the epiphysis, and extended for some distance along the periosteum; and had the patient lived, we should subsequently have found the shaft of the bone bare and necrosed, as in the instance of W. C., which I described to you as an example of "acute periostitis" of the fibula.

In passing, I would observe that we may learn an important lesson from the details of the last two cases I have related, which is, in deep-seated acute abscess occurring in children or young persons, especially if in the legs, thighs, or along the humerus, make a point of inserting your finger through the incision you have made to allow the pus to escape, and carefully examine the condition of the bone, and the direction in which the abscess runs; for you will not unfrequently find, in cases of this description, that the shaft of the bone in the neighbourhood of the collection of matter is denuded of periosteum, and very possibly the cavity of the abscess passes towards the upper or lower extremity of the bone, the inflammatory action having commenced at the line of ossification between the epiphysis and diaphysis, and extended along the periosteum of the shaft, ultimately involving the soft structures of the limb. Counter openings and efficient drainage are most important elements in the successful treatment of these cases: for example:—

C. H., aged four, admitted into hospital on July 1st. This boy's father died of consumption, and his mother is at the present time attending the Hospital for Diseases of the Chest, at Brompton. There is no history of syphilis. The patient was attacked with pain in the right knee seven days before coming into hospital, and a few days afterwards the joint became swollen. He was then seen by Mr. Pearce Gould as an out-patient, and at once ordered into the hospital. At this time the report states that C. H.'s right knee was swollen and inflamed, and below the joint fluctuation could be felt; the redness and swelling extended beneath this joint. The child was suffering from high fever and great constitutional disturbance. None of the other joints of his body were affected. The day after admission an incision was made immediately below the outer part of the joint, and another about three inches down the leg. The finger could be passed through these openings down to the tibia, which was denuded of periosteum, and a probe was readily inserted through the tibia between the diaphysis and upper epiphysis. Pus escaped freely from the wound, and a drainage-tube having been passed through the incision, the child's leg was fixed to a back splint. Subsequently it became evident that the inflammatory action had involved the knee-joint, which continued red and swollen after the treatment above referred to. Free incisions were therefore made on either side of the patella, and drainage-tubes passed through the joint. The leg and thigh were kept absolutely at rest, and well-applied pressure was made on the affected joint with cotton-wool and an elastic bandage; the dressings were changed night and morning, so as to keep the parts clean. The fever subsided; and although our patient did not leave the hospital until the end of November, he was then able to walk about the wards, and, with the exception of a stiff joint, has perfectly recovered the use of his limb.

In this case I have little doubt that the disease commenced at the line of junction of the upper epiphysis and diaphysis of the right tibia, and that the inflammatory action extended upwards into the knee-joint and down the periosteum along the shaft of the bone. The free incisions relieved the tension, and, together with the rest and pressure applied to the part, prevented the inflammation from extending.

It is a remarkable fact that we have lately had two cases of epiphysitis of the upper end of the humerus under treatment in the hospital, the little patients being admitted into the wards within a few hours' time of each other. They were both of them brought under treatment almost from the commencement of the disease, and were treated by free incisions and drainage under Listerian principles. They both recovered.

Before leaving this subject I must refer to one other case illustrating the circumstances of what is usually described as suppurative periostitis of the trochanter, or upper extremity of the femur. A. B., aged three, a sickly little girl, but in whose family history no evidence of tuberculous disease could be detected. Mr. Glassington reports, that about a month before the child came into hospital she fell down a flight of stairs, and a day or two afterwards she complained of severe pain about the left hip. The parts became much swollen in consequence of the injury. The patient was admitted into hospital on November 19th. Her left thigh was flexed on her abdomen, and the parts round the hip-joint involved in a large abscess. I had the child placed under the influence of ether, and cut into the collection of matter. On passing my finger down to the trochanter, I found that it moved freely on flexing and extending the thigh, but the head of the femur was separated from the shaft, and remained immovable in the acetabulum. An opening was made through the back of the thigh, and drainage-tubes were passed through the limb so as effectually to prevent matter from collecting round the neck or upper part of the femur. The limb was fixed to a Thomas's splint, and subsequent extension from the foot of the bed was employed, so as, if possible, to counteract the tendency of the muscles to draw the end of the bone backwards on the dorsum ilii. The patient remained under treatment until the following April, when she was able to move about the wards, although her left leg was an inch and a half shorter than the right one. We have lately re-admitted this girl into the hospital, in order that we might take a note of her condition at the present time, now eighteen months since she was under my care. A. B. is a plump, healthy little body; the sinuses round her diseased hip have long since closed. The trochanter and upper extremity of the femur on the left side are drawn backwards and upwards on the dorsum ilii, so as to cause considerable shortening of the limb; but she has an excellent false joint, and, with a cork sole to her boot, can run about the wards with scarcely any perceptible lameness.

In spite of extension and all we can do, it is generally impossible to prevent shortening of the affected limb in cases of this description, for the muscles passing from the pelvis to the thigh are apt to drag the upper end of the femur, separated as it is from its head, on to the dorsum ilii. I expect cases of this kind are among those which have given rise to the impression that shortening of the limb in hip-joint disease is due to dislocation of the head of the bone on the dorsum ilii. I by no means assert that epiphysitis of the head of the femur always terminates in shortening of the affected limb; for instance, had this particular case been brought under our care at an earlier stage of the disease, it is quite possible that by means of rest and proper treatment suppuration might have been prevented, and the injured structures have resumed their healthy functions.

In cases of epiphysitis commencing at the line of junction between the head and neck of the femur, it follows from the anatomical relations of the parts, that the inflammatory action must extend to the capsule of the joint rather than to the periosteum of the shaft of the bone. Hence the less frequency of acute periostitis of the upper end of the femur than of its lower extremity in cases of epiphysitis; for a more detailed account, however, of this subject, I would refer you to my Lecture on diseases of the hip-joint.

I have seen one instance of what I believe to have been epiphysitis, commencing at the cartilaginous line of growth of the lower jaw (symphysis). Doubtless, disease of this kind occurs from time to time in the flat bones around the centres of ossification. In the case referred to the patient was only four months old; the child travelled with his parents, under circumstances which could not be avoided, over a very protracted journey during the severe cold of last December. Within four days of the arrival of the child in London he was seized with high fever, his face became greatly swollen, especially his chin and front of the neck, which was of brawny hardness. The only way to account for the symptoms was that the child had been frost-bitten; the chin, in fact, looked like a large chilblain. Matter formed in the course of a few days, and a free opening having been made through the swollen tissues down to the bone, the lower jaw was felt to be denuded of its periosteum, for some distance on either side of the symphysis; a probe could be passed through the symphysis directly into the child's mouth.

The patient died within twelve days of the time I first saw him, but I was refused a post-mortem examination.

The question may naturally be asked, why place so much stress upon the disease we are considering being due to epiphysitis? It is evident, if the line of junction between the epiphysis and diaphysis of a bone be disposed to take on an inflammatory action after injury, because it is an actively growing structure, that a similar action is likely to occur in the deeper layers of the periosteum, the long bones increasing in bulk from the osteoblasts of the periosteum. This is perfectly true, and the point may be at once conceded if it be granted that suppurative periostitis commences more frequently in the epiphysis than in the periosteum in proportion to the rapidity of the growth in length of a bone as compared with its growth in circumference, and from the peculiar susceptibility which this line has to be injured by a fall or the careless handling of a nurse. From a practical point of view, we find that the majority of cases of so-called suppurative periostitis involve, if they have not commenced at, the line of junction between the diaphysis and epiphysis, and I think it is important to bear this fact in mind. We should not rest satisfied, in cases of this description, with merely incising the soft structures and periosteum in one or two places along the shaft of the bone, but should invariably make a special examination as to the condition of the epiphysis, and, if necessary, introduce drainage-tubes so as to prevent matter from collecting in and about the head of the bone. In this way we may save a neighbouring joint, and probably the medulla in the cancellated tissue of the diaphysis, from suppuration, and preserve the patient from septo-pyæmia — the almost constant result of acute osteo-myelitis.

In cases of epiphysitis, or suppurative periostitis, in which, as in several of the cases I have detailed, a limited portion of the shaft of the bone is denuded of periosteum, the diaphysis being separated from the epiphysis, effectual drainage must be established in the first instance. Among children the disease may then pass away without necrosis of bone. If, however, after effectual drainage, combined with rest and well-applied pressure, the disease continues to increase—it may be a portion or the whole of the diaphysis being separated from the periosteum,—it is necessary to cut down and remove the denuded portion of the bone, which not only acts as a foreign body, keeping up the discharge, but is also a source from which purulent matter is constantly being absorbed into the circulation. Under these circumstances, never take away the epiphysis; in fact, remove nothing but the diseased portion of the shaft of the bone — it may be of the femur, tibia, or any other long bone. Amputation of the limb might be necessary, but should, of course, only be resorted to in order to save life.

After what I have said on this subject you may naturally inquire why it is, in instances of inherited syphilitic epiphysitis, that suppurative periostitis so seldom occurs. It seems to me, syphilitic epiphysitis is largely due to disease affecting the periosteum surrounding the extremity of a bone, and, like most syphilitic changes affecting the osseous system, its tendency is towards recovery rather than to suppuration. The supply of blood in cases of this kind, passing from the soft structures to the actively growing end of the bone, is interfered with by the changes advancing in the periosteum, and so degenerative alterations occur in the part, and separation of the epiphysis takes place. The pathology, therefore, of this disease differs from that of the affection we are considering, although its results, so far as the separation of the epiphysis and diaphysis is concerned, are similar. I shall have more to say on this subject when speaking of syphilitic disease of the osseous structures, but the following case illustrates a point in connection with epiphysitis to which I wish to direct your attention. Instances of the kind, so far as my experience goes, are of rare occurrence, but the details of the case demonstrate, to my mind, the fact that among infants who cannot be suspected to have suffered from inherited syphilis, separation of the epiphysis from the diaphysis may take place by a process of degeneration, and not of inflammation.

An officer of the Indian army, with whom I had lived soon after going out to Bengal, and who had been my intimate friend and patient for many years, married a young lady, whose parents I also knew very well indeed, and I am convinced that neither my friend nor his wife's father had ever suffered from syphilis. After marriage this officer had four fine healthy children who are alive and well; but his wife, having suffered severely from dysentery, came home from India in June, 1877; she was pregnant at the time, and what with the disease, her condition, and sea-sickness, she arrived in London in a fearfully exhausted state; she was, however, safely delivered at her full time of a male child. The infant was a poor emaciated little creature, and when I saw him a month after his birth, his arms lay almost motionless by his side, and his right leg was not moved with the left one. There was marked deformity of the child's right elbow and knee joints; the limbs in these parts were precisely as if they had been fractured, the epiphyses being separated and movable on the shaft of the bones. The child died within two months of birth.

From the specimens I now show you of the bones entering into the formation of the right elbow and knee-joints, you see that the epiphyses are actually separated from the diaphyses, but there is not, nor was there when I made the post-mortem, the slightest sign of inflammation in the part, but simply caries, or molecular disintegration, of the tissues at the line of junction between the diaphysis and the epiphysis of the affected bones.

There was no indication of disease of the flat bones of the skull in this case.

The mother of this child has since been confined, and her infant is a strong healthy little girl.

From these details it seems to me we cannot admit the changes in these bones to be due to inherited syphilis, although the symptoms and the post-mortem appearances of the parts almost precisely resemble the condition found in inherited syphilitic epiphysitis.

LECTURE IV.

TUBERCULOUS, OR SCROFULOUS, AFFECTIONS OF BONE.

THE condition of the system commonly described as scrofulous, or tuberculous, may be said to consist of a constitutional weakness affecting certain tissues. This weakness may arise from inherited defects, from improper or deficient food, impure air, or other conditions by means of which the healthy nutrition of the tissues has been interfered with. It is impossible, before the changes we are considering have occurred in these tissues, to detect any chemical or histological alterations in their constituents; nevertheless, these tissues are characterized by pathological tendencies. They are extremely susceptible to injury, and when inflammatory action has taken place among them, the process is often very protracted, and the alterations produced in the part differ from those which occur among healthy people in the tendency they have to the formation of a vascular fibro-nucleated tissue. So that scrofulous inflammation may be described as a condition, among those persons subject to this constitutional weakness, to the formation and infiltration of the affected tissues by a lowly-organized cell-growth, and this cell-formation, as it increases in bulk, exercises such an amount of pressure upon the vessels of the part as to interfere with the circulation of blood through it, and so causes the death or necrosis of the affected tissues.

Tuberculous osteo-myelitis of the head of the tibia, or lower end of the femur, is frequently difficult to appreciate in the early stages of the disease, because of the thickness of the soft tissues intervening between the affected bones and the skin, but in other localities, as, for instance, in the head of the first metatarsal bone (a situation in which scrofulous inflammation of the medulla is by no means uncommon), we may watch the symptoms and course of the disease with tolerable precision.

For instance, a pale anæmic-looking lad, with a history of phthisis on his mother's side of the family, was lately sent into Luke's ward by Dr. Hughes Bennett. Some months before I saw this lad, he believed he had injured the ball of his left great toe; at any rate, for some time past, if he attempted to run or walk any distance, the part became very painful and obliged him to lay up for some days. After resting the limb the pain subsided, and he could resume his employment. On comparing the patient's feet with one another, it was evident that the head of the first metatarsal bone of the left foot was somewhat enlarged and very painful on pressure. But under appropriate treatment and rest these symptoms subsided, and the patient left the hospital apparently cured.

In this case there is reason to suppose that subacute osteo-myelitis had been established in the head of the bone; irritation and swelling of the periosteum and soft parts external to it had occurred, together with some amount of effusion into the neighbouring joint. Supposing, however, that this patient had been neglected, it is by no means improbable that, in the course of time, fistulæ, leading to disintegrating bone, would have been the sequel, and sooner or later other bones of the foot would have become affected in the same way; from the absorption of matter into the system the boy's health would have become impaired, and in the end partial amputation of the foot might have been necessary.

The following case, reported for me by Mr. Jacquet, affords us a favourable opportunity of studying the pathological changes which occur in these cases of tuberculous osteo-myelitis.

F. C. H., aged five and a half, a bright intelligent fair-haired boy, has resided all his life in a country village. His father and mother are healthy industrious people, and no direct trace of hereditary disease can be discovered in the history of the family. Our little patient fell from a swing some two years ago, and struck his right knee against a tree. The part became painful and swollen, and has continued to give more or less trouble from the date of the accident up to the time he came under my care. The patient's right leg was then partially fixed at an obtuse angle on his thigh; there were no sinuses about the injured knee, which was free from pain, except at night. The position of the limb was such as to prevent his placing his foot on the ground, and it was considered advisable, as there was some movement in the joint, to divide the contracted hamstring tendons, and bands of fascia in the popliteal space. Having done this the leg was easily extended and retained in position for a month by means of a plaster of Paris bandage. It was subsequently found, however, that his leg from the knee downwards was paralyzed. Friction and electricity were persistently employed for five months without benefit; and, in the meantime, the child had gone through an attack of measles and mumps, which told upon his general health; symptoms of more acute disease manifested themselves, the patient's temperature rose every night to 102°, and the knee-joint became painful. Under these circumstances the limb was amputated immediately above the condyles of the femur. The wound healed without suppuration, and the patient left the hospital a month after the operation.

This history gives us the outline of a class of cases, instances of which are to be met with in almost every surgical ward throughout the country. The patients are usually either delicate children or young persons under adult age; as a rule, they are members of a phthisical family, and often present the characteristic features of persons suffering from a scrofulous diathesis.

They frequently date the commencement of the disease of the bones from which they suffer to an accident, a sprain, or over-exertion. Under some such circumstances the patient is attacked with deep-seated pain situated in the extremities of one of the long bones, or it may be in the cancellated structure of one or more of the bones of the hand, foot, or vertebral column. The pain is almost always aggravated by pressure on, or any movement of, the affected part. It is worse during the early part of the night, so that a child who has appeared comparatively well through the day will cry for two or three hours after going to bed from pain in the affected limb. The first onset of pain is sometimes prolonged over a period of several weeks; the soft structures round the seat of disease become more or less red and swollen. Although the medulla in the cancellated tissue of one of the long bones may be the structure primarily involved, it is quite possible that the synovial membrane in a neighbouring joint may speedily be implicated in the abnormal action going on in the part, and synovitis, for the time being, becomes the marked feature of the case. I have no doubt that in many instances in which enlargement of the ends of the bones is said to exist the swelling is due, not to the expansion of the ends of the bone, but to induration and thickening of the synovial membrane and soft structures in contact with the diseased bone.

In other cases the advent of the disease is insidious; there are no signs of external inflammation—in fact, the only complaint the patient has to make is that he suffers from a deep-seated gnawing pain about the affected bone. He can hardly tell you the exact seat of the pain; it is somewhere, perhaps, in the foot or heel, but he seldom puts his finger on a peculiarly painful spot. A sudden jog or violent exercise is certain to produce an accession of pain. Under the influence of rest these symptoms subside, to recur, however, within a short period; and so, if one of the lower extremities is affected, as we too often see in cases of hip-joint disease, the patient is confined to his room for a considerable time, he becomes weak and anæmic, the local affection gains ground, the diseased bone rots, and an opening forms through which the disintegrated structures escape.

On the other hand, we often meet with patients who have suffered from long-continued attacks of pain and other symptoms such as I have described—in the lower end of the femur, for instance; but the symptoms subsequently subside, and the functions of the limb are restored.

In the case of F. C. H. immediately after the limb had been amputated the popliteal artery was injected with carmine, and the knee-joint carefully examined. No pus was discovered in it; the crucial ligaments were healthy; the synovial membrane had been beautifully injected, and seemed healthy. The inner articular facet of the tibia was covered with cartilage, its central portion, however, being reduced to an extremely thin layer, beneath which numerous spots of extravasated vermilion were perceptible; the cartilage surrounding this central portion had a glistening healthy appearance. The articular surface of the inner condyle of the femur (only partially injected) was, over its central portion, covered with hard nodular projections of eburnated or sclerosed bone, but the surrounding cartilage was healthy. The articular surface of the outer condyle of the femur was more extensively diseased, for the free surface of the bone recently formed from this epiphysis was rough and denuded, but this central ulcerated portion of the bone was enveloped by a thin border of cartilage, which was normal in structure on its free surface, although its deep surface was separated from the bone by a layer of granular cells; the cartilage surrounding the articular facets was healthy. The outer articular surface of the tibia was in much the same condition as that of the corresponding portion of the femur, but in addition we found a cavity filled with a jelly-like substance passing from its free surface through the epiphysis into the shaft of the bone.

It was evident from the condition of the synovial membrane that the disease of the joint had not commenced there, the articular surface of the bone being subsequently implicated, for not only was the synovial membrane comparatively healthy, but the cartilage surrounding the articular facet of the bones entering into the formation of the joint was normal in structure. Not a single vessel could be traced from the synovial membrane through the outer healthy portion of the cartilage to the central diseased part. The fact is the articular cartilages mainly derive their blood-supply from the vessels contained in the cancellated structure of the bone to which they are attached, and in the bones of children there is no calcareous lamina to separate the medulla of the bone from the articular layer of cartilage.

If we examine sections made through the diseased portions of these cartilages we find that in many places a thin stratum of normal cartilage lines their free surface, but that between this and the growing bone there is a layer of granular cells which are evidently continuous with a similar spawn-like tissue filling much of the cancellated structure of the bone. In these preparations, therefore, there is evidence as to the fact that the abnormal condition of the cartilage did not commence on its articular, but in its attached or deep surface, and that the diseased action had spread from thence outwards towards the joint.

I do not deny that ulceration of the free surfaces of these cartilages exists in isolated spots, and that the base of these ulcers is formed by healthy cartilage, so that at first sight we might conclude that the disease had begun on the articular surface of the cartilage; but if we make sections through these ulcers down to the osseous formation in the epiphysis, we find that under the layer of cartilage forming the base of these ulcers there is a crop of granular cells, such as I have before referred to, growing from the medulla into the cartilage, and so altering the nutrition of the cells at the surface of the cartilage; but in this degeneration of cartilage on its free surface there is none of the spawn-like tissue to be found which, in specimens taken from the deeper layers of the cartilage, is to be seen in such abundance.

We find that the growth which has invaded the cartilage from the bone consists of a multitude of round granular cells, among which are some "giant-cells," and throughout the new growth, a stroma of hyaline fibres can be demonstrated; there are few, if any, vessels to be seen in this fibro-cellular mass; but if we examine it in the cancellated spaces of the bone we find that it is intimately connected with the outer coats of the smaller arteries, growing as a nodulated mass from these vessels. These nodules are in places invested by healthy medullary tissue. I believe it is from the pressure exercised by this over-abundant cellular formation against the rigid wall of the bone, that the circulation in the vessels is interfered with; and when once the circulation is impeded, the elements of the new growth pass into a state of fatty degeneration.

If we examine these injected sections through the epiphysis and shaft of the bone, we see a number of small opaque spots in the cancellated structure, composed of degenerated fibro-cellular tissue, such as that which I have above described, and the cavity passing from the articular surface of the outer facet of the tibia into the shaft of the bone has evidently been produced in this way. The contents of this cavity are jelly-like in consistency, and on making transverse sections through it, and into the surrounding osseous tissue, we find that its circumference consists of spawn-like tissue, continuous with that in the cancellated structure of the bone, the vessels also passing from the medulla a short distance into the jelly-like substance, and there terminating by anastomosis; but the central part of the cavity is occupied by disintegrated cells and fatty matter, in which there are no vessels, but a number of "giant-cells." You will also observe that there is an entire absence of anything approaching to new bone-formation, or sclerosis, round this cavity, or anywhere else in these specimens, except in the nodules I have described as existing on the denuded surface of the femur.

We may therefore fairly conclude, that the cancellated tissue of the bones entering into the formation of this diseased knee had, during life, been occupied by an abnormal fibro-cellular formation, which had not only invaded and destroyed the articular cartilages, but had also produced the cavity in the tibia, and the death of certain portions of the bone, by impeding the supply of blood to the part, and so inducing softening and fatty degeneration of the tissues, which are finally washed out of the bone by the stream of fluid percolating through it from the surrounding vascular area. For you must distinctly understand that in the living bone the parts beyond a cavity such as I have described are extremely vascular, and it necessarily follows, that when the tubercle breaks down and forms, as it were, a well in the centre of the bone, the surrounding fluid will drain into it. There must ultimately be an outlet for this pent-up fluid, which escapes, of course, through the passage of least resistance—it may be into a joint, or externally through the skin. We cannot doubt but that the constant drain of fluid from the more healthy through the diseased tissues greatly influences the condition of the latter, and it seems reasonable to suppose, that if by any means we could control the supply of blood to the parts, we might modify the abnormal action going on there.

From another specimen I have here, you may notice that a considerable number of fibro-cellular patches, similar to those we have just been discussing, may, in place of degenerating into small abscesses, undergo calcareous changes. In this preparation, taken from the end of the tibia of a young woman, whose leg I amputated on May 27th, a cavity extends from the lower articular surface for an inch and a half upwards towards the medullary canal.

In the fresh specimen, the bone surrounding this cavity was extremely vascular (fungating caries). On making thin sections through the bone, and soaking them in glycerine, we notice a number of opaque spots, about as large as a No. 3 shot, situated in the cancellated tissue, and on further examination we find that these opaque spots consist of extremely hard nodules of calcareous matter, which lie in a structure composed of a fine reticular network of adenoid tissue, its meshes being crowded with round cells, resembling lymph-corpuscles (spawn-like); besides these cells, there are innumerable free nuclei filling up the interstices between the cells; the peripheries and envelopes of these nodules are sharply defined, the surrounding medulla being normal.

We have evidently, therefore, in this specimen an example of tubercle which has undergone calcification in its centre.

On making a further examination of these sections of bone, we observe several non-vascular, opaque, grey, and soft patches, about the size of a split-pea; and under the microscope we discover that the outer layers of these formations consist of precisely the same elements as those which surround the calcareous deposits, but the centres of these opaque patches contain disintegrated osseous and fatty matter. In fact, the tubercular growth has liquefied, and there seems no reason to doubt that the large central cavity in this tibia has been formed by a precisely similar process, there having, in the first instance, been a growth of tubercle in the cancellated tissue of the bone, which had undergone degenerative changes, its liquid contents ultimately escaping into the ankle-joint.

In the case of F. C. H., it seems as though the diseased action had been excited by the injury our patient had received; the nutritive changes in the soft parts entering into the formation of the cancellated tissue of the bone had then been interfered with. Doubtless an abnormal process such as I have described is greatly influenced by inherited constitutional defects which the tissues may have acquired, but there is no reason whatever to suppose that abnormal cell-growths of the kind cannot arise independently of inherited faults; and so it happens that in a scrofulous or anæmic subject the outcome of an inflammation is not the safe issue of a cicatrix but the dangerous issue of local tuberculosis. The local inflammation takes on the characters of a new growth instead of healing. In the case we are investigating, it is, however, quite possible that the law of interrupted transmission may have affected the issue for although we could discover no history of constitutional disease in the lad's family, his ancestors may have acquired a taint by means of which structures entering into the formation of their bodies 'had become predisposed to the rapid overgrowth of certain elements, and it only wanted, in the case of this child, an injury such as he received to upset the balance of the nutritive changes going on in the bone, to bring out prominently the defect in the organization of the medullary tissue.

I have another case I wish to bring to your notice before proceeding to consider the more general questions concerning tuberculous disease of the bones. You may remember, last September, seeing a little girl (G. W.), aged six, in the Chadwick ward, suffering from angular curvature of the spine and a large pelvic abscess connected with diseased vertebræ. After death we found that the bodies of several of the dorsal vertebræ were in a condition which is commonly described as "fungating caries." On making sections through these vertebræ, we see that in places the contents of the cancellated tissue are of a deep crimson colour, especially along their anterior free surface, where the bone has been partially destroyed, and presents a soft, florid (granulating?) appearance.

On examining specimens of the material contained in the diseased cancellated tissue, we find that it is composed of precisely the same fibro-cellular growth I have described as existing in the bones constituting the knee-joint we have been examining; in fact, the medulla contained in cancellated structures of these vertebræ is choked, and towards the anterior surface of the bone has degenerated into pus which has passed along the line of least resistance and so reached the right groin.

But you will observe that in this instance, as in the case of F. C. H., the vertebræ are not enlarged, no new bone has been formed in or around the seat of the disease. This case, therefore, differs essentially from one of ordinary chronic inflammation, in which the increased energy manifested by the cells contained in the medulla results in the formation of new bone, by means of which a limiting membrane, if we may so call it, is formed round the focus of the disease (see page 56). In tuberculous affections new bone is not produced until the tubercle has completely degenerated, and is removed either by nature or by the hand of the surgeon. The rough treatment which a bone receives under these latter circumstances may set up a different action from that caused by an insidious disease like tubercle, which seems to destroy the tissues among which it forms by appropriating their nutritive fluid to its own purposes.

Beyond the fact of there being no new bone formed in these cases of diseased vertebræ (and the same remark applies to all the specimens I have shown you), the trabeculæ in the cancellated tissue are not rendered denser (sclerosed), as they are in instances of chronic inflammation of bone. These are some of the broad and characteristic features between tuberculous specimens of bone and those resulting from ordinary inflammation. I cannot agree with those who consider fibro-cellular formations of the description I have described as existing in these bones as being simply the result of chronic inflammation, leading to granulation tissue, because I think ordinary inflammation could hardly exist in the contents of the cancellated tissue of a bone for two years without causing enlargement or sclerosis of its trabeculæ and the formation of new bone, or else the products of the inflammation would have caused the formation of pus and suppuration in the part; but in these specimens there is an absence of the characteristic effects of ordinary inflammation. I admit that it may be difficult to define the distinctive features between the fibro-cellular formation constituting the disease I have described to you and those which are usually considered as granulation tissue; but there is, nevertheless, a difference between them, for the tendency of granulation tissue is towards the formation of an organized fibro-nucleated tissue, but that of the growth I have described is unquestionably towards degeneration, and in this respect, as well as in its structure, it so much resembles tubercle that we have every right to consider the disease with which we have to deal as being tuberculous in its nature.

An authority on these matters observes, in a recently published lecture, that "although the pathology of many of these cases is obscure, the doubt is practically of slight importance; for, in respect to treatment, whether they are scrofulous or whether they are not, one law must be rigidly observed, that is the law of absolute rest." I cannot concur in these views, for I think that to arrive at an accurate idea of these affections of the bones is a matter of the first importance with reference to treatment, for if these diseases depend, in the majority of cases, on local injury—being, in fact, the result of a blow or contusion occurring in a healthy child—then it seems reasonable enough that the parts should recover their normal condition if kept at rest. On the other hand, if the majority of these affections of bones depend on constitutional defects, which we have good reason for believing can only be overcome by means of an unlimited supply of sunlight, pure air, and food, then, valuable as rest may be as a curative agent, it is nevertheless only an adjunct (and too often, in my opinion, a misused one) in the treatment of the formidable class of cases we are studying.

It seems to me, if these affections of bone are only the result of contusions it is impossible to explain how it happens that the children of the natives of Bengal, for instance, rarely suffer from disease of this description; but, supposing these alterations in bones depend on tuberculosis, we can understand the immunity of native children from affections of the kind, because scrofula is not common among their parents. The argument may be carried a step further, for if affections of the bone, such as we are discussing, depend on contusions, but few children should escape joint-disease, considering the innumerable falls and accidents which our little ones must meet with before they are four years of age. On the other hand, it is reasonable to suppose that the third, and perhaps the fourth, generation of children, reared in the dirty streets and polluted air of the dwellings occupied by our London poor should acquire a kind of tissue different from that possessed by their forefathers, or other children reared under more favourable conditions. One effect produced on these town children seems to be a predisposition to the formation of a constitution which we recognize as the scrofulous, in which the tuberculous affections frequently occur.

I have lately received a most valuable work by Dr. V. P. Gibney, of New York, on "the strumous element in the etiology of joint-disease, from an analysis of eight hundred and sixty cases." Dr. Gibney asks the question, Can joint-disease occur in a non-strumous child? After an exceedingly fair and judicious summary of his eight hundred and sixty cases, Dr. Gibney remarks of joint-disease, whether traumatic or non-traumatic, that patients gave, with one or two possible exceptions, histories, which proved conclusively, at least the existence of a strumous element in the etiology, and established, as far as facts and figures can establish it, the untenability of the traumatic theory of bone-disease as generally understood.

These considerations are of importance, for it is not by simply studying the anatomical and pathological changes which have occurred that we shall gain a thorough knowledge of the circumstances of tuberculous disease of bone; we are evidently also bound to exercise our minds upon the conditions which influence its progress during life, and none of these is of greater importance than the fact that tubercle, being a constitutional disease, depends greatly upon hereditary and hygienic imperfections for its development and growth.

LECTURE V.

TUBERCULOUS DISEASE OF THE BONES (*continued*): TREATMENT—LYMPHADENOMA.

In treating cases of tuberculous osteo-myelitis, the great difficulty we have to contend against is the want of reparative power of the tissues under which our patients labour; if we can only succeed in placing them in conditions leading to the healthy growth of the various structures of the body, they will recover from the disease. In other words, in treating these cases of tuberculous inflammation of bone we must endeavour to give full scope to the laws which govern the normal nutrition of the body; and consequently place our patients in such circumstances as are most conducive to health. In proportion as we recognize this principle and act up to it, so will our success be in overcoming the effects of the disease we are now considering.

The following case illustrates the outline of treatment which may generally be adopted in the earlier stages of tuberculous disease of bone.

An intelligent, pale, bright-eyed boy, eight years of age, in whose mother's family phthisis existed, was sent to me under the following circumstances. His general health had been good up to the present time. About six months ago he began to complain of pain in his right heel, which was increased by exercise. The idea for some time was that the pain was due to rheumatism, but the symptoms persisting, and the lad being unable to run about with his companions, further advice was thought to be necessary.

On examining the right heel there were no external indications of disease; there was nothing wrong with the joint, but on making firm pressure over a particular spot on the outer surface of the os calcis, the child at once exclaimed that the seat of pain was there, and on stamping his heel on the floor, pain in the same spot was complained of, although, as he explained, when walking, the uneasiness from which he suffered seemed to be diffused over the heel. He had been confined to the house on several occasions for three or four days together within the past six months, on account of symptoms such as I have described.

I am aware that in a case of this kind the diagnosis is open to question, and could only be arrived at after carefully watching the case for a month or so; but my opinion was founded on the family history, and the long-continued fixed pain in the heel, which, on examination, was discovered to be confined to a definite spot in the os calcis.

In a case of this description, believing, as I firmly do, that tubercle in its early stages may be cured, it was, of course, out of the question ordering the child st in the way of confining him to the house; for supposing the symptoms he complained of were due to the growth of tubercle in the cancellated tissue of the os calcis, evidently fresh air and exercise were needed to invigorate the child's general health, and so stay the progress of the disease. At the same time it was equally important to preserve the heel from concussion or injury, and this we have done by ordering boots for the boy, made so that the os calcis might rest on a broad flat surface. The sole of the boot was of india-rubber, and lined with felt, the object being to give the bones of his foot freedom, and to have no unnatural pressure on the os calcis, with a light elastic material for the foot to rest on, to preserve it as far as possible from concussion. Coarse woollen stockings were recommended, not only to keep the foot warm, but to act as a pad to the inside of the carefully-made boot. The lad was cautioned not to run or jump, but to take regular walking exercise.

Counter irritation, in the form of tincture of iodine, was to be continued for a considerable time, together with cod-liver oil, and country air, the patient residing, if possible, on a chalk or gravel soil, and being protected from chill by flannels and careful management. Under treatment of this kind, extended over a period of three years, this lad has gradually lost all tenderness or pain in the os calcis, and is growing up to be a fine, active young fellow.

We may take a second case. A lad, twelve years of age, with a history of phthisis on the father's side some two years ago, after over-walking, was seized with great pain in the left ankle. The part became inflamed, and the lad was unable for several weeks to put his foot to the ground. These symptoms subsequently subsided, to recur, however, after a short interval; and so matters have gone on. The patient has consulted several eminent surgeons, and they agreed that the lower end of the left tibia was diseased, and that nothing but absolute rest and patience could be of any use. Acting under this advice, the boy was never allowed to put his left foot to the ground, and seldom to leave his couch.

From want of exercise, and an in-door life, the patient's health began to fail; and towards the commencement of last summer it was a matter for serious consideration if the development of tubercle had not commenced in his lungs, and it was at length determined to treat the local disease as being of tuberculous origin, and depending, therefore, upon constitutional defects, which were most likely to be overcome by out-door amusements. As the lad could not take much active exercise on foot, he was taught to swim, and very soon became an expert in the art; he also took to riding and rowing, and was permitted to walk about whenever the absence of pain in the leg would allow him to do so.

Under treatment such as this, the patient wonderfully improved in health and spirits, and although he suffered for upwards of three years from attacks of pain which laid him up for four or five days at a time, he has grown up to be a strong, healthy young fellow, the disease of his leg having entirely ceased.

I think, if we consider the matter, aided by the knowledge I have endeavoured to inculcate, it seems probable that walking would not augment the local symptoms in a case of this kind, for the ankle-joint evidently was not involved in the disease, but the medulla contained in the cancellated tissue of the lower end of the tibia was implicated.

The disease, however, is not in the osseous framework which supports the body; this, even in the affected end of the tibia, we have reason to think, was not implicated in this case. In walking, therefore, I suppose that the diseased medulla is not pressed upon; its bony framework, as in the case of the brain, is a protection to it. No doubt exercise, by increasing the supply of blood to the part, may distend the medullary vessels and sinuses, and so, perhaps, produce pain in the part by pressing on the diseased medulla; but even if this were the case, it is doubtful whether the augmented blood-supply in this stage of the disease might not be useful rather than otherwise.

It is upon these principles that I think Thomas' splint, and the plaster of Paris bandage, in the early stages of disease of the head of the femur, and in affections of the bones of the ankle and knee-joint, are so useful. I wish I had words at my command to express to you my strong feeling regarding the importance of allowing patients suffering from incipient symptoms of tubercular disease of the bones to move about, without injurious pressure on the affected tissues, and thus procure that without which they cannot be restored to health—air and light. To me it is painful to see little patients suffering from disease of the various bones of the body such as we are considering confined in the close rooms, or the wards of our London hospitals, *at rest*, until they have passed into a hopeless condition of general ill-health.

The question as to how much exercise may be allowed in instances of tuberculous disease of the bones of the lower extremities is a matter of the greatest importance, and I believe the simplest solution of it is to leave the matter, to a great extent, in the hands of the patient, his own feelings and sensations, however young he may be, being the surest guide we can follow.

If a child, suffering from disease of the bones of the leg or foot, is disposed to run about, by all means let him do so, protecting, however, the weak part as much as possible from injury by mechanical appliances.

And this remark is applicable to diseased bones other than those of the lower extremities. For instance, a child was brought to us the other day with "something peculiar about his neck." On examination, it was evident that the long-continued stiff-neck complained of was caused by rigidity of the cervical muscles, due to tuberculosis of the bodies of the upper cervical vertebræ. Any movement of the little patient's head or concussion of the spine caused the child considerable pain. The patient was laid in bed for a few days, and then Sayre's bandage and back splint were applied; the little patient was at once able to get up and go about the wards without the slightest pain, and was sent into the country, where he gradually recovered health and strength.

With reference to this kind of support, I consider the profession is under a great obligation to Dr. Sayre, of New York, for introducing the plaster of Paris bandage (applied whilst the patient is suspended) in cases of tuberculous disease of the vertebræ. I have employed this system of bandaging or support in a considerable number of cases, and the result has been much more favourable, in my opinion, than any other means of support that I am acquainted with, especially in instances of recent disease occurring among young persons; in fact, in precisely the class of cases in which diseases of the spine are so difficult to treat. An objection has been raised to "Sayre's" system of bandaging, because, it is argued, nothing but harm could arise from suspending a patient if the vertebræ have become anchylosed. But I need hardly remark that anchylosis of the vertebræ does not take place so long as tuberculous disease of the vertebræ is actually progressing, the condition in which, above all others, we claim for Sayre's plan a superiority above any other treatment. The author of this system hardly proposed that it should be applied to cases of anchylosis of the bodies of the vertebræ, unless simply as a means of support.

Care is required in adjusting the plaster of Paris bandage, not to have too much pressure over the prominent spinous processes of the diseased bones, otherwise the skin covering them is apt to ulcerate, and give rise to considerable trouble. There can be no question as to the necessity for fixing the bandage well round the pelvis as a base of support to that surrounding the trunk; but the details connected with this system of bandaging can only be learnt by practice in the wards of the hospital.

The same principle may be most advantageously applied to other diseased bones. For instance, in the case of tuberculous disease of the head of the femur, extension having been kept up for some time, and while the extending force is still used, so as to keep the head of the diseased bone from pressure against the acetabulum, a plaster of Paris bandage may be applied from below the knee, round the limb, and over the pelvis, thin strips of tin being inserted between the folds of the bandage. If skilfully applied while extension of the limb is kept up, a bandage of this kind is frequently of the greatest comfort to the patient, enabling him to move about on crutches or with a stick without pain. I find that many patients prefer the plaster of Paris bandage to Thomas' splint.

In some instances of incipient tuberculous disease of the bones, I believe accurately applied leather strapping round the affected part is most useful; the pressure seems to prevent the soft parts around the bone becoming indurated and unhealthy, and I cannot help thinking, that by means of tightly applied dressings we can regulate the blood-supply to the diseased bone. But, whether this idea is correct or not, my own experience is that in cases of this kind tight strapping with leather is an aid to treatment not to be neglected, and it can, of course, be employed in conjunction with the principles upon which Sayre's splint is founded. The strapping often causes a good deal of pain during the time of, and immediately after, its application; but the patient subsequently experiences relief, and is better able to move about. We have lately had several instances in the wards demonstrating the advantages to be derived from this treatment. It is not to supersede the rules I have already laid down in the management of these cases, and much less is it to be relied upon alone as a method for curing the disease.

A plan of treatment formerly much resorted to for the cure of scrofulous disease of the bones seems to have dropped out of fashion of late. I refer to the actual cautery applied over or as near as practicable to the seat of pain, before disintegration of the tubercle has occurred. Severe counter-irritation of this kind is often a valuable curative measure, and is hardly employed with sufficient frequency at the present day in instances of this form of disease.

Supposing a patient applies to us with tuberculous disease of one or more bones which have degenerated into a soft, putty-like matter (not pus), which has forced its way beneath the skin, forming an elastic swelling or chronic abscess, as it is often called. If the collection of matter is connected with a single bone—as, for instance, with the first metatarsal bone—it is well to let the tubercle in the bone continue to break down and destroy itself, but we should be careful not to open the abscess so as to admit the external air into the part, which might set up putrefaction, and entirely alter the nature of the process going on there. I advise you to protect the inflamed skin, and preserve it intact as long as possible, in the way we have been doing in the case of F. W., now in the Chadwick ward. When you find there is no chance of preventing the skin from giving way, make an opening into the abscess, under the carbolic spray, and allow the degenerated tissue to escape, closing up the puncture with collodion and cotton-wool. You may very likely have to reopen the skin to allow further débris which collects under it to escape.

If there is clear evidence that the ends of one or more bones entering into the construction of a joint are affected with tuberculous inflammation, the disease having passed on into the stage of disintegration of the tissues, the joint also being affected, what are we to do then? There are some surgeons who believe that scrofulous affections of bone never get well; and, under circumstances such as I have described, they would advise amputation or excision of the diseased joint. But it is remarkable how much may be done by patience and favourable hygienic circumstances among young persons. The following case, reported for me by Mr. W. Quicke, illustrates a system of treatment we have found advantageous in this class of cases.

J. G., aged fifteen. The boy's mother is a very delicate woman, and his brothers and sisters strumous-looking children. Our patient is a fair-haired lad, extremely pallid, with enlarged cervical glands, and precisely the subject one would expect to see pass on into a phthisical condition. Some two years ago he sprained his ankle while running, and, although he was subsequently able to walk about, it caused him pain, and at length he was obliged to go to an infirmary, where he remained in bed for four months. From that time up to the present the ankle-joint has continued swollen, and he has been unable to put his foot to the ground. On admission, we found the lower extremity of the right tibia was extremely painful on pressure, the ankle-joint was distended with fluid, and the ends of the bones were denuded. The boy was in very great pain and suffering from constant fever. On February 27th, the patient being under chloroform, I opened the ankle-joint freely under the carbolic spray, and, at the same time, with a full-sized hand-drill bored a hole from within outwards, and another from before backwards through the lower end of the tibia, and then passed horse-hair drains through these openings and laid another one through the joint; at the same time I divided the tendo Achillis. The wounds were dressed antiseptically, and, from the time of the operation, the patient's condition gradually began to improve.

J. G. was subsequently sent to Margate for a month, and then to Walton for two months. He has since been engaged under a gardener at Croydon; there has been no return of the disease; the lad has a sound foot, and has grown to be a strong, healthy young fellow.

You have seen precisely the same treatment carried out in the case of M. S., a girl who has just left the Chadwick ward; in this instance, however, the case was still more unpromising, because the patient was older, and the knee-joint was the seat of the disease; but I have every reason to be satisfied with the result. The girl has got a good and useful limb, although the leg had been condemned to amputation in a consultation held soon after she came under our treatment.

My object in these cases has been to relieve the tension of the joints, and by means of drainage through the ends of the diseased bones to draw off the accumulation of serous fluids and the products of the disintegrated tissues, and thus to allow the blood to resume its passage through the diseased parts of the bone, and by acting on the remaining healthy cells contained in the medulla, to enable them to build up new and more stable tissues in place of those which had been destroyed by disease. To the mind's eye the system adopted somewhat resembles that of draining swampy land and clearing away the under-wood in a close damp plantation, so as to give freedom of action to the vegetation we desire to cultivate.

We can hardly have a better illustration of what I mean than is afforded us by the history of one of our patients in the Luke ward. G. B., aged twenty, was admitted into the hospital four years ago, suffering from extensive disease of the bones of the right foot of two years' standing. His father died of consumption, and the lad is a delicate, strumous-looking young fellow. When first he came under my care he suffered from the existence of several sinuses leading down to carious bone; his right foot was extensively affected with tuberculous osteo-myelitis. As the boy's health was very much impaired, I amputated his foot at the ankle-joint. He subsequently made a rapid recovery, and has since continued his occupation as a coach-builder.

G. B. has now returned to the hospital suffering from lupus, an affection which we may consider to be a scrofulous disease of the true skin. Dr. Stowers describes it as a local expression of a constitutional disease known as struma or scrofula, which is essentially chronic in its character and attended with ulceration. If you examine these specimens, which have been carefully stained, of the medulla taken from the bones of G. B.'s amputated foot, and compare them with the soft structures removed from the growth of lupus on his nose, it would be impossible for you to discover any difference between them. This young man, in fact, some three years ago suffered amputation of his foot in consequence of the bones being affected with tuberculous disease, and he has now returned to the hospital with a scrofulous affection of the skin covering the end of his nose, for the relief of which arsenical paste and various other caustics have been employed.

On April 12th, this patient being under the effects of ether, I broke down the surface of the soft tissues covering the lupus sore on his nose with my thumb-nail, and then with a Vidal's spoon removed any of the lupus growth which remained on the surface of the skin. In the course of three weeks the entire sore, which had been occupied by the lupus ulceration, was covered with a fine delicate fibrous tissue very much resembling the skin in appearance; the disease was, in fact, cured in a most satisfactory manner. It is a precisely similar plan of treatment (as far as possible) which I employ for the relief of scrofulous disease of the bones, whether it occurs in the head of the femur, or in any other bones we can reach. It frequently happens that in disease of the bones it is quite impossible for us to remove the whole of the affected tissues, as we did in the case of the lupus ulceration. But it seems to me that we may frequently destroy a very considerable portion of the diseased medulla, and so alter the nature of the inflammatory action which is taking place in the bone. In operations such as I refer to, it is very desirable to preserve the periosteum and the outer shell of the bone; but, as a rule, I am disposed to think that you are far more likely to err in the direction of not removing enough than in that of taking away too much of the diseased medullary structure.

Under treatment of this kind, combined with effectual drainage, so as to relieve the tension of the surrounding tissues, rest, pure air, and plenty of milk, most satisfactory results may frequently be obtained. But I need hardly remark that cases of this kind require great patience on the part of both patient and surgeon in their treatment; the prognosis depends much on the extent of the disease and the part affected, and still more on the general condition of the patient. A continued abnormal rise of temperature and pulse at night must always excite our suspicion, leading us rather to suspect that some of the other structures of the body, beyond the bones, are implicated; for the thermometer, unless in advanced stages of tuberculous disease of the bones, is of little assistance to us in forming our prognosis.

This fact is illustrated in the case of J. M., aged eight, in Luke ward. Mr. G. Butler (one of my most zealous dressers) kept careful records of this instructive case; the little patient had well-marked symptoms of disease of the right hip-joint, the pain being almost entirely referred to the region of distribution of the obturator nerve over and about the knee; he was kept in bed, and extension applied to the limb, but for several weeks there was a constant high temperature, increasing at night. I frequently directed your attention to the patient as we went round the wards, and explained the cause of my great anxiety as to the result, my fears being roused by the readings of the temperature chart. Dr. Allchin examined the boy's lungs, but discovered no evidence of tubercle in them; the optic disc did not indicate neuritis, and so matters went on until suddenly tubercular meningitis declared itself, and the patient subsequently died in convulsions.

The pia mater, lungs, and mesentery were in places covered with miliary tubercle. The acetabulum was perforated, and a mass of caseous material was found under the pelvic fascia, and in the synovial membrane. There was no pus in or about the joint. The cancellated tissue of the head of the femur was full of a cell-growth which it was impossible to distinguish from that existing in the pia mater or lungs.

Keep in mind the fact that a high temperature in cases of hip-joint disease, or in fact of any tubercular affection of the bones, should always be looked upon with suspicion; depend on it, in the majority of these cases there is mischief going on in other tissues beyond those of the bone.

My own impression is that the longer we deal with cases of advanced tuberculous disease of the bones, the clearer we appreciate the importance of time and general hygienic conditions as affecting their issue. Nevertheless I think, when we have made up our mind that we have done all in our power to improve the condition of the patient, but that the disease is gaining ground, we are bound to take away so much of the bone as has become rotten before sacrificing a joint or the limb.

There is, however, a most important qualifying circumstance with reference to this remark, and that is regarding the age of the patient. In children you may take away several of the bones of the foot, or the head of the femur even, and yet it is wonderful what excellent recoveries they make, so that we are unquestionably bound never to sacrifice any portion of a limb we can possibly save among young patients.

In the same way in children we do not hesitate, when necessary, to excise the articular surfaces of the bones entering into the formation of the ankle-joint, whereas with the same amount of disease in an adult I should recommend an amputation below, or at, the knee-joint. We have examples illustrating the truth of this doctrine in the wards at the present time. I described to you the condition of the bone in the case of A. W., the lower end of the tibia being occupied by a cavity together with tuberculous deposits, some calcified, and others undergoing cheesy degeneration. In this instance, as the young woman was strong, and apparently healthy, I amputated the leg at its lower third, but above what seemed to be the seat of disease. The stump is a remarkably good one, but the disease of the bone has reappeared. She now (nine months after the operation) complains of gnawing pain in the stump, which increases at night, and she is as convinced as I am that we shall find the end of the bone the seat of fresh disease. It would evidently have been better had I amputated at the knee-joint in the first instance.

The case becomes more serious when the bones entering into the knee-joint are involved; but even here, in the instance of children, we may gain admirable results by means of careful treatment when the active symptoms of disease have subsided, leaving, perhaps, a partial displacement of the tibia backwards and fibrous anchylosis, the leg being bent on the thigh at an obtuse angle. We may often, by dividing one or more of the tendons of the hamstring muscles subcutaneously and then breaking down bands of contracted fascia, straighten the leg and keep it in this position until the parts have formed new attachments for themselves. In other cases of this description we cannot straighten the limb without excising a wedge-shaped piece of bone from the lower end of the femur and upper surface of the tibia. Operations of this kind are sometimes referred to as excisions of the knee-joint; but I need hardly remark that if the end of the femur and tibia have grown together the knee-joint has ceased to exist, and consequently to describe these as cases of the removal of bone in order to overcome the deformity produced primarily by disease of the bones or knee-joint is incorrect, and likely to mislead you as to the value of excision of the knee-joint for the relief of disease.

LYMPHADENOMA (HODGKINS' DISEASE).

We seldom meet with cases of this affection in our surgical wards, but I may refer to the disease in connection with tuberculosis, as I have lately had an instance of the kind under my care in the hospital.

J. N., aged nine, was sent into the hospital by Mr. Goldie, medical superintendent of Stepney Sick Asylum, an institution which it is well worth your while to visit, for I have seldom seen an establishment for the sick more perfect in its arrangement or more efficiently conducted. Our patient had been under Mr. Goldie's care for about a year: he was a fair-haired, blue-eyed, intelligent lad, and although suffering from enlargement of the cervical glands on the right side of his neck, his general health was good until some six months ago, when the glands commenced increasing in size very rapidly. J. N.'s family history pointed to the fact of his having inherited a tuberculous diathesis. On admission into our hospital five months after the commencement of the rapid growth of the cervical glands, the patient was extremely blanched; the whole of the right side of his neck was occupied by a large tumour which felt like a firm sarcomatous growth, with here and there soft patches scattered throughout its substance; the skin over the tumour was healthy and freely movable over the morbid growth, which had hardly caused the patient any pain.

The lymphatic glands on the left side of the neck were greatly enlarged, as were the glands in the axilla, as well as those in the elbows, groins, and popliteal spaces. There was no enlargement of the liver or spleen, no albumen in the urine, nothing abnormal in the choroid or retina; the heart and lungs were healthy; there was no anasarca or dropsy; the patient's blood was very carefully examined, and there was found to be no increase in the number of white corpuscles which it contained.

Soon after admission into hospital the patient was seized with pleurisy; his breathing and deglutition had previously been much impeded by the pressure of the tumour on the trachea and œsophagus, and he speedily sank under the increased difficulty in respiration caused by the effusion into the pleura.

On making a post-mortem examination we found that not only were the glands above-mentioned greatly enlarged, but the œsophageal, bronchial, mesenteric, and, in fact, all the lymphatic glands in the body, were hypertrophied.

The tumour occupying the right cervical region was composed of a mass of enlarged glands; in places, however, it was soft and almost gelatinous. The liver and spleen were of normal size and colour, with the exception of a number of yellowish-grey nodules scattered over their surface; from these nodules processes passed into the parenchymatous structure of these organs. In the bases of both lungs similar growths were observed.

The kidneys and supra-renal capsules were healthy.

I injected the vessels of this patient's right tibia through the femoral artery, and I now show you the specimens thus obtained. You will observe that the vermilion injection has filled the vessels of the periosteum, the nutrient arteries, and the vessels contained in the Haversian canals of the compact tissue of the bone, but it has failed to penetrate into the blood sinuses contained in the medulla of the cancellated tissue. On examining sections of the bone, we find that its cancellated structure is choked by a dense fibro-cellular tissue which is precisely similar in appearance to that seen in the gelatinous portion of the tumour in the neck. I believe it is by the pressure exercised by this cellular growth (confined by the unyielding bone) on the vascular sinuses which has prevented the injection entering these channels; and if so, it is probable the circulation of blood through them must have been impeded during life, so that we have here in the medulla a condition analogous to that which I have described to you as existing in cases of tubercular disease of the bones. With the naked eye we can see patches of the fibro-cellular formation, some of considerable size, in the medullary canal; they look very like what they have often been described as resembling in other parts of the body—small lumps of suet—being, in fact, hypertrophied portions of the normal elements contained in the cancellated tissues and medullary canal of a growing bone.

Holding, as I do, that the deep layers of the periosteum, and the medulla of bone, are derived from cells originally contained in the temporary cartilage, it is interesting to observe in this specimen that the periosteum in contact with the shaft of the bone is crowded, like the cancellated spaces, with round cells imbedded in adenoid tissue.

Although the hard portions of the tibia have not as yet suffered from the abnormal condition of the medulla which it contains, nevertheless, had the patient lived, it seems probable, in consequence of the defective supply of blood passing through the cancellated tissue, that it would ultimately have degenerated and broken down in precisely the same way as we have seen occur in cases of tuberculous disease of the bones; in truth, it appears that the characteristic features of lymphadenoma much resemble those of scrofula. It may be modified by syphilis or some other constitutional taint, and, as I have said before, the condition of the medulla is identically the same in these affections, so far as the naked eye and the microscope enable us to observe them.

I may further remark that in leukæmia accompanied with enlargement of the spleen, generally the effect of malaria, the patient often being anasarcous, and his blood always containing an excess of white corpuscles, the condition of the medulla is different to that seen in this case of Hodgkins' disease, for in instances of advanced leukæmia from the above cause, even in growing bones, we find the blood sinuses of the cancellated spaces crowded with rows of white blood-corpuscles—injected, I might almost say, with them; and the round cells of the medulla are comparatively few in number, the space they should occupy being filled with fatty matter.

LECTURE VI.

SYPHILITIC DISEASE OF THE BONES.

It seems to me we may best approach the subject of syphilitic diseases of bone by considering those inherited affections of the osseous system arising from this cause, which, as a rule, become manifest when the patient is from seven to eighteen years of age; we may then refer to infantile syphilitic disease of the bones; and, lastly, to syphilitic nodes and gumma, the result of acquired syphilis.

The following case, the notes of which were kept for me by Mr. G. Shaw, illustrates the history and pathological changes commonly met with in instances of inherited syphilitic affections of the bones occurring between the age of childhood and the adult period of life.

M. C., aged eighteen, has resided all her life in London, and, so far as she can remember, enjoyed good health up to the present time. She has the characteristic features of inherited syphilitic teeth; the bridge of her nose is broad and sunken; her frontal eminences are protuberant; her skin of a dusky hue. Her intellectual powers are imperfectly developed;

she does not know her letters, and is childlike in her manner. She has mitral disease of the heart. Through information received from a cousin, it is certain that M. C.'s father was suffering from the effects of syphilis before his marriage; her mother is still alive, but has only had one child. The patient has been employed as a maid-of-all-work in a small lodging-house; as a rule, she has laboured hard for some sixteen hours every day, and has been indifferently fed.

Twelve months ago M. C. noticed what she describes as a small swelling on the lower and outer side of her left leg, just above the ankle-joint. She cannot remember having received an injury to the part, and for some time she took but little notice of it; the swelling, however, increased, and gradually assumed its present dimensions, causing her considerable pain, especially towards evening. About three months since she became lame from the above-mentioned cause, and applied for relief as an out-patient. She was ordered increasing doses of iodide of potassium; but as it was evident that she required rest and food as well as medicine, she was taken into the hospital on June 14th. There was then a clearly-defined enlargement of the lower end of the shaft of the left tibia and fibula, extending round the entire circumference of the bones for about an inch and a half above the ankle. The swelling was most prominent a little above the joint; the skin and soft tissue over the part were natural in appearance, although indurated. The ankle-joint was unaffected. There was no enlargement of any other bone in the body. On admission, the patient was much out of health; the pain in the affected limb was constant, and increased towards night; it was greatly aggravated by pressure applied over it. She was ordered to remain in bed; a properly-adjusted splint was fixed to the leg and foot, so as, without pressure on the enlarged bones, to keep the parts absolutely at rest; the patient was put on full diet, and the iodide of potassium together with iron and quinine were administered.

It would be superfluous labour to attempt to follow out the details of this case. Suffice it to say that the patient was more or less constantly under our care until March, 1877. During this time she was sent into the country. Iodine having failed, she was put on a course of mercury; the actual cautery was used, Scott's dressing, and, in fact, everything we could think of, employed; still the enlargement of the bone remained, and the pain continued in spite of all we could do to relieve it; but I was unable to detect any disease of the ankle-joint.

On leaving London for a time in February, M. C. passed under the care of one of my colleagues; and on March 27th, finding effusion had occurred into the ankle, he inserted a full-sized drainage tube through the joint.

On my resuming charge of the wards on April 12th the patient was suffering from high fever, dry tongue, a jaundiced skin, frequent purging, and profuse sweats—in fact, from septo-pyæmia. The drainage tube was removed, but there was a considerable discharge of matter from the wound. She continued to grow worse, and so it was determined to amputate the limb some three inches above the ankle-joint. The operation was accordingly performed on April 18th, and from that time the patient recovered, and left the hospital before the end of May.

We had evidence that M. C.'s father had syphilis before the birth of his child; the condition of her incisor teeth, the sunken bridge of her nose, peculiar forehead, and imperfectly-developed intellect, pointed with unmistakable clearness to the fact of her having inherited the disease from which her father suffered. Doubtless, as an infant, she had had inflammation of the Schneiderian membrane, and probably blotchy and scaly rashes together with other symptoms of syphilis; but these had passed away, and, as is frequently the case, the syphilitic child grew up to be a robust, but weak-minded, person, and then the disease of the bone appeared.

The form of disease we are considering is most frequently met with in patients suffering from inherited syphilis, from their eighth to their twentieth year of age. It usually commences as a slowly-increasing enlargement of the ends of one or more of the long bones, including the phalanges of the hands and feet; it may, however, appear in the vertebræ, pelvis, or flat bones. The pain in the affected part is generally intermittent, increasing towards night. When in bed, starting of the affected limb is not an uncommon symptom. Neighbouring joints are seldom implicated, unless in an advanced stage of the disease; its characteristic feature being a gradual increase in size of the affected part of the bone, uncomplicated with joint-disease or necrosis of bone.

These syphilitic affections of bone are not unfrequently met with about the upper end of the femur; but there, as in other localities, those parts of the bone which are not covered with periosteum remain free from disease; and so, although there may be considerable thickening of the femur about the trochanters, the head and neck of the bone remain healthy. The same fact is demonstrated when the disease involves the extremities of the humerus, or the bones near the knee and ankle-joints, for those parts covered by synovial membrane, or articular cartilage, are never primarily implicated in the abnormal growth or disease which we are now considering.

This remark applies to cartilage as well as bone. It is only when this structure is covered by perichondrium (a modified form of periosteum), such as we find in the cartilage composing the larynx, that syphilitic affections of this structure are met with. This fact, which is drawn from the clinical study of many instances of the kind, leads to the conclusion that, in the majority of these cases of syphilitic disease, the abnormal action commences in the periosteum, frequently in that portion of it which surrounds the extremities of the bones, and that the actual disease of the bone which sometimes occurs is secondary to the affection of the periosteum.

The course which most of these cases run, points also to this conclusion, because the slowly enlarging and painful shaft or extremity of the affected bone is unquestionably amenable to the influence of mercury. Under a judiciously administered course of this drug, the disease gradually disappears, although it may have existed for months. But I know of no abnormal condition of the fully-formed osseous structure, or rather, I should say, medullary tissue, leading to enlargement of the bone, which is beneficially influenced by mercury or any other drug. Nor do I think it possible, from the minute anatomy of the parts, that such could be the case. We cannot imagine a syphilitic or any other form of inflammation which could run its course unchecked for a considerable time in the medullary structure of a bone, and then give way to specific treatment; for during the course of any such persistent action in this delicate structure, sclerosis or other changes in the bone would have occurred, from which the parts could hardly recover or regain their healthy functions, as many instances of long-continued syphilitic disease certainly do, after a few weeks' administration of the iodide of mercury.

I may go a step further and observe, that doubts exist in my mind as to the accuracy of the description frequently given regarding portions of diseased bone having "expanded" in consequence of either acquired or inherited syphilitic inflammatory changes occurring in the cancellated tissue (ostitis); such a change may take place, but the more carefully we examine specimens of the kind, the clearer it becomes that in the majority of them, the enlargement of the bone is due to layers of periosteal new growth, superimposed one over the other, like the bark of a tree, so as to produce a greater or less increase in the size of the bone.

But the question naturally arises, how was it that an amputation became necessary in a case of this kind? For if there is one fact more certain than another regarding these syphilitic cases, it is, that a mercurial course, combined with patience, will cure the disease.

In reply to this question, in the instance of M. C., it was necessary to remove the rotting parts from which her system was being infected, in order to save her life. No doubt the access of the impure air of our hospital wards, passing into the joint through the unprotected drainage-tube, had set up dangerous putrefactive changes in the tissues, and this decomposing matter was constantly being absorbed into her system, producing symptoms of septic poisoning, from which she was suffering before the operation.

I was averse to an excision of the joint in this case, because, as a rule, among adults, instances of excision of the ankle-joint do not make good recoveries, and the existence of septicæmia further hindered such an operation. Then, again, this patient being infected by inherited syphilis was a bad subject for an excision of a larger joint. Lastly, the disease of the heart under which M. C. laboured was of such a nature as to lead Mr. Beer, our chloroformist, to demur to giving anæsthetics, and to urge me not to keep our patient under the influence of ether longer than was necessary.

These considerations, and the fact that I was not sure if I could remove the entire disease by excising the joint, induced me to amputate the leg at its lower third.

Before the operation, we might well have been under the impression that the patient was suffering from enlargement of the lower cancellated extremity of the bones of the leg, for there was evidently an increase in the size of the bones in this situation, which was marked on comparing the left with the right leg. In the records of the case the expressions the "enlargement," and "swollen" end of the tibia and fibula, recur over and over again, and had the case terminated favourably, we might have supposed we had cured an instance of "inherited syphilitic ostitis." But you now see how false our conclusion would have been, for on examining the diseased ends of these bones we find that their enlargement is not due to ostitis, but to the growth of layers of new bone outside the compact bone which was originally formed round the lower epiphyses of the tibia and fibula. A sheath of bone has here grown from the periosteum, in structure and appearance precisely like the callus round the site of a badly-set fractured bone, and we have an enlargement of the lower inch and a half of the tibia and fibula, not from changes occurring in their cancellated tissue, but from a periosteal growth. This is, as I have before remarked, one of the features of syphilitic affections of the extremities of the long bones, whether inherited or otherwise, distinguishing them in a very marked way from tuberculous disease, which consists in an abnormal fibro-cellular growth in the cancellar tissue of the bone.

We noticed that in cases of tuberculous disease of bone the indications afforded us by the thermometer are hardly to be relied on. How different is this in syphilitic affections! If we examine M. C.'s temperature chart, we find that week after week the mercury in the thermometer showed that at night the temperature of her body invariably rose to 101° or 102°, and fell to 99° towards morning. Iodide of potassium did not influence this abnormal temperature, but twelve grains of quinine invariably checked the rise of temperature for some days after it was administered.

Doubtless, as this growth of new bone surrounding the end of the tibia increased in density and thickness, the blood-vessels passing through it into the cancellated tissue would have been pressed upon and injured, and the nutrition of the medulla would have suffered, and in time might have been so defective that necrosis of the bone would have occurred, but not inflammation; and we might then have found the lower portion of the tibia dead and surrounded by new bone produced, as above-mentioned, from the periosteum. We see indications of the commencement of this process in sclerosis of the tela ossia within this periosteal growth; and also in this crescentic patch of necrosis which you observe at the lower end of the tibia, and which is remarkable as demonstrating in the osseous system the existence of the law which so often governs the extension of syphilitic ulceration of the soft parts, and which causes them to spread in a circular form.

In this case the contents of the cancellated tissue of the astragalus are not only perfectly healthy, so far as we can ascertain by the microscope, but its condition affords us a good illustration of the way in which new bone is formed from the medulla after an injury, showing that the normal functions as well as the structure of this delicate tissue have been unaffected to any great extent by the disease progressing in the tibia and fibula.

On making sections through the astragalus we find its articular cartilage and the subcartilaginous layer of bone have entirely disappeared, their place being occupied by granulation-tissue, which is supplied with vessels continuous with those in the cancellated tissue of the bone; beneath this soft layer of granulation-tissue there is a broad stratum or layer of newly-formed bone. The round cells of the medulla filling the original spaces in the cancellated tissue of the bone have become surrounded by an homogeneous material, and are embedding themselves in a deposit of bone-earth. Had calcification progressed in this layer, we should have found a stratum of dense bare bone projecting into the joint; as sclerosis advanced into this layer, the vessels supplying the granulation-tissue on the articular surface of the bone would evidently have been cut off, and so this soft vascular structure would have perished, leaving the newly-formed and denuded hard layer of bone beneath it. This layer of bone having once formed, in the manner I have described, from the cells contained in the cancellated tissue, would not only have effectually prevented the absorption of matter from the joint through the medulla into the blood, but would also have prevented the bone-producing elements contained in the proximal ends of the tibia and astragalus uniting, or becoming anchylosed.

Part of this new subcartilaginous bone has become thoroughly organized, but the larger portion of it contains a number of the round cells of the medulla, which are being imbedded in bone-earth, or, in other words, are undergoing transformation into lacunæ; after a time most of these cells would disappear. It seems to me that when we read of inflamed bone possessing numerous lacunæ produced by the proliferation of the bone-corpuscles, it is, in fact, nothing more than a thin layer of the medullary structure in a stage of transformation into bone, such as I have described; for it is hardly likely that the cells of the original bone-corpuscles can increase and multiply to any great extent after ossification has once been completed around them.

We have not, however, finished with M. C.'s tibia. You will observe, on making a longitudinal section of the bone, that near the articular surface the cancellated tissue is occupied by a white, cloudy material, very like that noticed in the cornea of persons suffering from interstitial keratitis, or the neoplastic formation observed in syphilitic retino-choroiditis.

When examined under the microscope, we find that the cancelli of the bone in the zone of cloudy material is occupied by ill-defined, soft-looking, nucleated cells, surrounded by fatty molecular matter. This material seems to have infiltrated among the normal elements of the medulla, and then to have spread in a circular form.

I wish to draw your special attention to the fact, that the area of increased vascularity is a consequence of, and not the cause of, the necrosis of this small piece of bone; and this is the rule in most cases of ostitis. The deep injection of the bones seen in instances of this kind is seldom uniform, but is rather found passing as broad crimson bands through the cancellated tissue, enclosing patches of comparatively bloodless structures, in which, and not in the vascular area, we find the greatest alterations in the elementary tissues of the part. In some cases these changes arise from an increased growth of the round cells choking up the blood-channels; in others, a fibroid material, such as we see here, appears to induce a similar result; but in all these instances of syphilitic disease, extensive, and probably imperceptible changes had taken place in the living tissues before the stage of vascular engorgement or increased collateral circulation, attended by the characteristic symptoms of inflammation, declared themselves.

As a rule, the neoplastic syphilitic formation which occurs in the cancellated tissue of bone, probably only excites transient hyperæmia in any one spot of the surrounding medulla. But the neoplastic formation sometimes appears, by its presence, to disturb the nutrition of the structures among which it forms, and so becomes surrounded by a zone of congested vessels. These vessels run up to the border of the cloudy neoplasm, but they do not enter the new formation, and so a stationary zone of congested vessels encircles the neoplasm. In consequence of this vascularity of the part sclerosis of the trabeculæ contained in the congested zone takes place, and, further, the round cells of the medulla proceed to manufacture new bone, as I described to you in the case of the articular surface of this astragalus; and thus the syphilitic neoplasm becomes enclosed in a layer of dense new bone, which necessarily limits the blood-supply passing into the affected area, and consequently death or necrosis of the bone occupied by the cloudy syphilitic neoplasm occurs, without suppuration.

Nor is it likely that new bone would replace that which dies, because the bone-producing elements of the medulla are, like the vessels, prevented from occupying the cavity left by the necrosed bone, being excluded from it by the layer of new and sclerosed osseous tissue formed in the manner mentioned above.

The account I have given you of the pathological changes noticed in this specimen is the history of almost all instances of syphilitic ulceration and necrosis of bone, in whatever stage of the malady the bones are affected. Cases of the kind are commonly met with involving the bones of the skull, the abnormal action commencing beneath the pericranium, or it may be in the diploë, and often only terminating in the removal of a portion of the skull, the cavity which is left remaining as a depression in the bone, surrounded by thickened and hard walls. But cases of syphilitic affections of the bone beginning in the medulla are rare, compared with instances of disease originating in the pericranium or external soft parts, and compromising the bone by cutting off its supply of blood, which naturally passes to it through the pericranium.

INFANTILE SYPHILITIC DISEASE OF THE BONES.

Affections of the bones among infants, resulting from inherited syphilis, were, I believe, first accurately described by Ranvier, some fifteen years ago: since that time Professor Parrot, of Paris, and Dr. T. Barlow, in this country, have added much to our knowledge in this portion of the field of syphilography. Dr. R. W. Taylor, of New York, in his work on the "Syphilitic Lesions of the Osseous System in Young Children," has given us the most complete and valuable work in the English language on the subject. There can be no doubt that as these infantile syphilitic affections of the bones have become better understood, lesions of the osseous system due to this cause have been found to be more frequent than was formerly supposed to be the case, and if one point more than another has come prominently to our notice of late years respecting this subject, it has been the existence of marked, I may say specific, abnormalities in the ossification of the parietal and frontal bones in cases of infantile syphilis: the question naturally arises, why the flat bones of the skull should so constantly be affected in inherited syphilis.

In the first place, I may remind you that a considerable portion of the outer osseous covering of the brain is developed in a peculiar manner from membrane, and not from hyaline cartilage; and if we study the ontogeny of the flat bones of the skull, we find that they are, in truth, dermal appendages. The skull cap, the central nervous system, cornea, choroid, iris, ears, teeth, and mucous membrane of the mouth and anus are "developed from the epiblast, the skin, fibrous layers of the germinal vesicle." And if you were asked, from a clinical point of view, to mention the structures most frequently affected in cases of inherited syphilitic disease, you would enumerate precisely the list I have above given. This is a remarkable circumstance, and seems to point to the theory I have already referred to (p. 2), that specific diseases, like fungi, elect definite tissues of the body on which they exercise their destructive influence, and that these tissues are intimately related to one another from an ontogenetic point of view. The relation between the skin and flat bones of the skull has been a recognized fact for many years past, as exemplified by the deeply-pigmented bones of the skull found in some of the black-skinned negro races, and, to some extent, among darkly-coloured Europeans.

The lesions of the flat bones of the skull found in the case of infants suffering from inherited syphilis have been accurately studied by M. Parrot. He describes the osteophytes, or abnormal growth of bone from the outer surface of these bones, as being confined nearly exclusively to the periphery, and at the commencement always around the anterior fontanelle of the frontal and parietal bones. More rarely they start from the temporals. They are very rare on the orbital arches and the occipital bone. They are only observed when the disease is of great intensity. They are at first lenticular elevations, red, violet, or greyish in colour, rising very abruptly from the outer table, porous and spongy, sometimes hard, very seldom smooth, like the normal bone. The cranial osteophytes extend little by little from their point of origin to the neighbouring parts, either preserving their original form or becoming elongated, or, indeed, assuming a crescentic shape. The frontal and parietal eminences are the last regions to be invaded, but it may happen that finally they are so, and then the entire vertex of the skull is covered by the osteophyte. The sutures themselves are united, which much modifies the development and the dimensions of the cranial cavity. The osteophytes increase in thickness, and in the most diseased parts may attain two and even three centimetres in thickness, ultimately presenting, in numerous specimens, a smooth and gradually raised protuberance from the surface of the skull, forming the characteristic "bossed" skulls of inherited syphilis, and which we can readily imagine to have been caused by a gumma, or soft node, as it is frequently called. In some cases the weight of the skull notably exceeds the physiological mean.

The cranial osteophytes are peculiar to hereditary syphilis. Among its usual forms there is one which is very common and quite characteristic. It consists in the presence of two or four eminences, separated by two furrows in the form of a cross; the one transverse, directed along the coronal suture, the other antero-posterior, along the sagittal suture. When these eminences are very prominent, and sufficiently extensive, a typical condition is the result. M. Parrot terms the skull thus deformed *natiform*, on account of the resemblance which its elevations present to the *nates*. The premature union of the sutures determines the arrest of encephalic development, which may result in idiocy. Skulls of this kind are frequently asymmetrical in the frontal or the parietal region, probably because the skulls are softer than normal, and so likely to be affected by pressure.

Together with the "bossed" condition of the skull-cap above described, due to the growth of cranial osteophytes, or nodes, M. Parrot refers to pathological conditions as existing in these bones in syphilitic infants which leave patches of the membrane, from which a great part of the cranium is formed, unossified. This state of things is best demonstrated by drying the skull-cap immediately after it has been macerated. On holding the dried bone up between your eye and the light small irregular patches of membrane may be seen filling in depressions in the bone. The surface of the affected bones often presents a worm-eaten appearance in some places; in others, small pieces of the bone look as if they had been punched out, and the openings in the skull thus made filled in with a piece of dried membrane. These thinned-out portions of the bone are of all shapes and sizes, but, as in rickets, are only met with in young children. This condition of the skull is produced, according to M. Parrot, by "syphilitic gelatiniform atrophy" of portions of the affected bones, the result being a condition hardly to be distinguished from that seen in many cases of rickets (craniotabes).

I have gone carefully into this subject, and can fully endorse M. Parrot's opinion as to the growth of osteophytes from the surface of the skull in the case of syphilitic infants, and I am equally convinced that his description of the worm-eaten, unossified portions of the skull-cap is also accurate; but I attribute these latter changes in the skull to a condition precisely similar to that which induces craniotabes in cases of rickets, believing that these pits or unossified spaces in the cranial bones are not peculiar to infantile syphilis; they may, and in my opinion unquestionably do, occur in non-syphilitic infants, resulting from mal-nutrition, as I shall subsequently more fully explain to you in my lecture on rickets. With reference to the pathological changes that are sometimes found in the long bones of syphilitic children, M. Parrot, and other authorities on the subject, have clearly demonstrated the existence of important alterations at the line of juncture of the diaphysis and epiphysis in these cases, by means of which the epiphysis may become actually separated from the diaphysis. The portion of cartilage bordering on the extremity of the diaphysis, instead of being transformed into bone, remains in a state of cartilage hardened with calcareous salts. The vessels disappear, and the diseased tissue extends towards the spongy part of the bone, from which it differs by its greater density and friability, and by a whitish colour like chalk. Dr. Parrot designates this the *chondro-calcareous* form of atrophy. But in other cases of infantile syphilis he finds the medulla of the bone presents a glistening and transparent condition, varying in colour from a garnet to a rose tint; a gradual diminution of the medullary cells occurs, and in their place a vascular fibrillar meshwork fills the open spaces in the bone. This state of things is necessarily followed by a soft and friable condition of the bone, causing the *gelatiniform* degeneration of inherited syphilis; a condition, in my opinion, hardly to be distinguished from that of rickets. An infant labouring under either of these forms of degeneration of the osseous tissue, in an advanced stage of the disease, presents the following characteristic symptoms:—The affected limb has an appearance as if the bones had been fractured. If the bones of the arms are diseased, the limbs lie stretched out straight and motionless by the child's side. When the infant is raised up his arms hang loose, and sway from side to side. The number of limbs affected differs in almost every case; sometimes all four are motionless, occasionally a joint is bent and stiff; when this is so, there is usually an abscess near the joint. Sometimes crepitation can be produced between the epiphysis and the shaft of the bone.

The following case illustrates the features presented by a patient suffering from the early stages of infantile syphilis affecting the long bones :—

J. W., aged two months, was sent with her mother into the Chadwick ward last October. The child since her birth had suffered from snuffles, and patches of roseola on her chest and back. She had eczema of the genital and anal regions, arising from the irritation produced by condylomata. We found that the bones of this child's fore-arms were enlarged above the wrist-joints; there were symmetrical nodular projections (osteophytes) of bone above the olecranon processes, and similar excrescences were found on the outer condyles of the femurs (these were about the size of a split horse-bean); there was enlargement of the bone over the greater trochanter of the right femur, and on the same side the lower ends of the tibia and fibula were swollen just above the ankle-joint.

The child's mother was in good health; she had been married four years, and during that time had had a miscarriage; this was her first living child. Her husband had complained of pain in his bones, and had ulcers, as his wife called them, on his chest and legs. As the patient's parents were in good circumstances, I only kept the child in the hospital for a week, to demonstrate to you that in the case of a young infant labouring under syphilis, a constant rise in the temperature occurs every evening. The patient was subsequently ordered to be brought as an out-patient, and directed to take five drops of the following mixture twice a day, in water:—Half a grain of bichloride of mercury, two drachms of iodide of potassium, and two ounces of water.

This treatment was continued for a month, when it was evident, not only that the child had improved in health, but there was a diminution in the size of the swollen bones. I then ordered the medicine to be given three times a day; it was subsequently gradually diminished in quantity. At present (six months after first seeing the child) she has lost all symptoms of syphilitic disease, and, although puny, is apparently thriving and in good health.

This is a typical instance of the course which this form of disease runs, provided it is brought under treatment in its early stages, and the child is well fed and cared for; but if the disease is neglected and the patient badly nourished, degenerative changes such as I have referred to occur between the diaphysis and epiphysis.

I hardly agree, however, with M. Parrot, that the abnormal action is confined to the soft structures between the diaphysis and epiphysis, for we meet with nodular swellings of the cranium and other bones, such as I have described; and, in addition, many of these cases present extensive and irregular growth from the

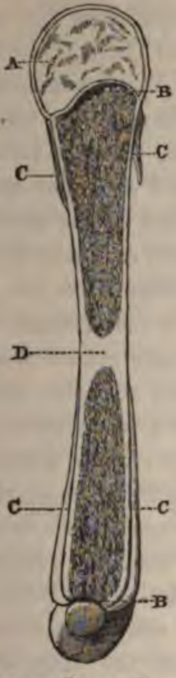

FIG. 2.—SECTION OF HUMERUS IN CASE OF INHERITED SYPHILITIC DISEASE OF BONE IN AN INFANT.

A, Head of humerus (epiphysis).
B B, Diseased tissue separating the diaphysis from the epiphysis.
C C C C, Thickened sheath of periosteum surrounding the ends of the diaphysis.
D, Shaft of humerus.

surface of the skull; and in most specimens, where there has been separation of the epiphysis from the diaphysis, the periosteum surrounding the affected part is more or less seriously implicated (see Fig. 2). So that although it appears from the clinical history and pathological changes that the diseased action is marked at the extremities of the long bones, where nutritive changes are the most active, it is not confined to the ends of the long bones, and does not manifest itself in the interior of those parts of the extremities of the bones which are not covered externally by the periosteum: the upper part and trochanters of the femur, for instance, may be involved in the diseased action, but the head and neck of the bone remain healthy.

These facts seem to point to the conclusion we have arrived at with reference to inherited syphilis of the bones of persons more advanced in years, which is, that in the majority of cases the periosteum is the tissue primarily involved in the diseased action, the bone being implicated in consequence of the periosteal abnormalities.

One of the most marked specimens of the effects of infantile syphilis on the long bones I have seen, was exhibited by Mr. Warrington Haward, of St. George's Hospital, at the Pathological Society. The changes occurring in the end of the diaphysis are well marked, the bone in this situation being separated from the cartilage; but I think there are indications of abnormal ossification of the periosteum, a sheath of new bone having formed round some of the diseased epiphyses, very like that which we have seen enclosing the lower end of the tibia and fibula in the instance of M. C. (p. 129). And, knowing as we do that the vessels supplying the extremities of the rapidly-growing bones of infants pass through the periosteum, it follows that, if this latter structure is diseased, the nutrition of the epiphysis must be compromised; and so it is probable, as in this case, degenerative changes have occurred in the soft structures at the extremity of the diaphysis.

It is very rare to meet with cases in which lesions of the bones, such as I have described, are the only symptoms of infantile syphilis, for the characteristic feature of this affection is, that it is accompanied with other well-known marks of syphilis; and it is hardly possible to mistake these for rickets or any other form of infantile bone disease. Moreover, rickets is preceded by recognized symptoms, and seldom manifests itself until the patient is some six months old, when the soft patches felt over the occiput and the symmetrically enlarged extremities of the ribs are characteristic features of the disease.

A case of inherited syphilis might possibly be complicated with rickets, as I have already remarked, and from the nature of syphilis, abnormalities arising from mal-assimilation are likely to occur, but even in an instance of this description the coryza, eruptions, and mucous patches will indicate clearly the nature of the affection. Dr. Taylor believes that syphilitic epiphysial affections may be confined to the phalanges and developed, the patient frequently suffers from localized pain in the bones, the part becoming excessively tender on pressure. A swelling, evidently arising from one or more of the bones, appears. This swelling is at first covered by healthy skin, and feels tense, almost hard, to the touch; the slightest pressure, however, causes excessive pain. At night, when the patient gets warm in bed, the pain in the affected bones is invariably worse.

A node of this description, if left to itself, may suppurate, or it may, after a time, gradually disappear; lastly, the irritation going on in the part may induce a growth of new bone from the periosteum, and, as I have before remarked, changes exactly similar to those I have described in the case of M. C.'s tibia may be the result. The size of a node produced in this way varies; sometimes they are not larger than a split pea, at other times they involve a very considerable portion of the affected bone. But even when of long duration, and although the new bone formed by the periosteum may appear to the touch to be firm and fully organized, it is quite possible their bulk may diminish and the newly-formed bone entirely disappear under full doses of iodide of potassium and bichloride of mercury, together with pressure applied by means of a pad of cotton wool and an elastic bandage. If inflamed, the skin may advantageously be covered with a layer of extract of belladonna before applying pressure. In other cases counter-irritation over the node by means of the linimentum iodi should be employed.

Gumma of Bone.—In the advanced stages of acquired syphilis the disease usually manifests itself in the periosteum (rarely in the medulla) in the form of gummata, which, after a time, may become entirely absorbed, or may degenerate into a soft, jelly-like material, leading to the molecular disintegration or caries of the structures in which they are situated.

Syphilitic nodes might therefore be conveniently classed under two heads—the one, as a rule, having a tendency to form osseous tissue; the other, the irritation caused by the poison being less, produces gummatous swellings. The former are accompanied with severe pain, affecting especially the bones of the skull and nose, frontal bone, sternum, clavicle, ulna, and tibia; there is an elevation of temperature at night, and general ill-health. The gummatous nodes, on the other hand, are frequently almost painless growths in their earlier stages; the patient has but slight, if any, fever, his general health, however, is gradually and seriously compromised. These gummy tumours of the surface of bone have often been confounded with osseous formations, and it is only recently that the idea has been abandoned that elastic flattened swellings of the kind do not depend on an exudation of plastic materials from the blood between the periosteum and the bone; they are now, however, admitted to be due to the growth of a soft tissue in the deeper layers of the periosteum. This tissue is formed of a gelatinous intercellular substance, here and there fibrillary, with proliferating cells—some fusiform, others round—of different sizes, for the most part pale, and containing one, or less often, two or more, pale nuclei. One of the most obvious features of this growth is its extreme fragility—the rapid destruction of its cells by a process of fatty metamorphosis or conversion into caseous material—so that its natural history is not unlike that of tuberculous formations in bone, and like tubercle, it degenerates, the tissues it has invaded are disintegrated, and if the effete products of their decay escape externally, an ulcer is produced, or, in the structure we are considering, caries of the affected bone occurs.

Periosteal gummata seldom have a long duration, differing in this respect from the osseous nodes. If their existence is prolonged, it depends on the production of new elements in the neighbouring parts; but, as a rule, gummata, after reaching a variable size, degenerate, and as they disappear there is a flattening or depression left in the site they occupied.

With reference to the diagnosis of periosteal gumma, I may remark that in compressible periosteal growths, whether originating on the bones of the extremities, trunk, or skull, our first inquiry must be directed towards determining if the patient is the subject of inherited or of acquired syphilis; a careful cross-examination will frequently be necessary in order to enable us to arrive at the truth in this matter. At the present time I know a gentleman who was advised to have his thigh amputated for supposed malignant disease of the lower end of the femur. The tumour proved to be a gumma, and disappeared completely under a mercurial course of treatment. Cases of the kind are not uncommonly complicated by ill-conducted mercurial treatment, for, strongly as I advocate the judicious administration of this drug in cases of syphilis, few surgeons have seen more of its ill-effects when abused than I have. With a syphilitic history, a comparatively painless, compressible, rather rapid formation, springing from the periosteum, is probably a gumma; and as a growth of this kind often involves the greater portion of the circumference of a bone, it may give us the impression that the swelling is produced by an expansion of the substance of the bone. Such a growth might be due to sarcomatous or medullary disease, but a few weeks' treatment with mercury followed by iodide of potassium will settle the point, and in a doubtful case it would be well to resort to a test of the kind, and by means of an exploratory puncture, to gain further information before arriving at a final conclusion on the subject.

The following case illustrates the truth of this remark. G. R., aged twenty-two, was admitted into the hospital on February 29th; he gave us a history, and had the marks of strumous disease of the cervical glands, but he distinctly denied having had syphilis. On examining his penis, however, the marks of an ulcer were clear, and he then admitted having had a sore, following connection, when a boy, fifteen years of age. The sore was a month or six weeks in healing; he had enlarged inguinal glands, and subsequently repeated attacks of sore throat and pain in the bones of his legs and arms.

On admission into hospital a painful swelling was found to occupy the whole of the upper part of the tibia; the skin covering it was deeply congested, and appeared to be involved in the tumour, which was considered by two of our staff to be, in all probability, a malignant growth involving the head of the bone. The lymphatic glands of the groin were not swollen, and the patient, although emaciated and worn out with pain from which he had suffered, did not present the appearance of a person affected with malignant disease.

A grooved needle was run into the tumour; nothing but blood exuded along its sides. An incision was made through the growth down to the bone, and a quantity of fatty, caseous material was pressed out of the wound; the bone beneath, though rough, was not necrosed.

A poultice was applied to the wound, and iodide of potassium, in full doses, with the bichloride of mercury was administered. The patient was at the same time ordered a full diet, and at first chloral hydrate at bed-time to relieve the pain. The swelling over the upper part of his tibia gradually subsided, and he subsequently left the hospital cured.

I think there can be little doubt that the tumour connected with the upper portion of this man's tibia was a gumma, and his subsequent history confirms this idea. The diagnosis would have been less complicated if, as in most instances of the kind, more than one gumma had existed; it was the large, solitary, rapidly-grown, and very painful tumour, arising from the head of the tibia, which seemed at first to point to a more dangerous form of disease.

From the account I have now given you of syphilitic affections of the osseous system, it is evident that necrosis of bone may occur from neoplastic formations in the medulla, the result of either inherited or acquired syphilis; but more commonly the death of a portion of bone in cases of syphilis is due to affections of the periosteum in the first instance.

Syphilitic caries, on the other hand, is more frequently preceded by a gumma. The bones of the nose and skull are peculiarly liable to be the seat of abnormal changes consequent on syphilis, and at times we meet with instances of very considerable disease of these bones; but in Europe, whether from the abandonment of the excessive use of mercury, or because syphilis is disappearing from among us in its worst forms, we certainly see comparatively few cases of the extensive destruction of the bones of the skull from this disease which appeared to be common in former times, and which is still met with among the inhabitants of some districts (especially among the hill tribes) of India, and other parts of the world.

LECTURE VII.

RICKETS.

GENTLEMEN,—The notes of the following cases have been kept by my dresser (Mr. Sydney Smyth). They illustrate the clinical history of the disease we have to study to-day:—Emily R., aged five, was admitted into the Chadwick ward. Her father and mother are healthy, well-to-do people living at Chelsea. We instituted careful inquiries regarding their family, and arrived at the conclusion that there was no evidence of hereditary syphilitic disease in the history of this case. The child's mother had been married nine years, and during that time had seven children; they were all living. The eldest girl had disease of the heart, and, like her brothers and sisters, marked deformity of the thorax and enlargement of the extremities of the ribs at their junction with the cartilages of the sternum, together with the square-shaped head, bulbous enlargement of the ends of several of the long bones, and other characteristic features of rickets. Another of the children, an infant, had had repeated attacks of laryngismus, and a third, two fits of convulsions.

Our patient's mother informs us that, when her children were about a month old, she was in the habit of feeding them upon bread and milk; it is true she also gave them the breast, but her supply of milk was very limited. After her children had become six or seven months old she allowed them to take small quantities of mashed potatoes and anything else on the table they could swallow; they were very fond of tea. As a rule, these children suffered from diarrhœa, and from profuse perspirations, which flowed for nights together from the skin of their heads and necks.

At the time of our patient's birth Mrs. R. was very ill, and, consequently, had even less breast-milk than usual for her infant, so that in truth the child was reared on bread and milk until she was about seven months old, after which time she was fed on anything she could manage to consume. The child suffered from long-continued diarrhœa; and, when about eight months old, she commenced perspiring at night profusely from her head and neck. She was extremely restless when laid down to sleep, rolling her head about from side to side, tossing off her blankets and refusing to be covered even with a sheet.

Emily R., like most rachitic children, was backward in teething; she cut her first tooth when fourteen months old, and had not completed her dentition until she was three and a half years of age; she was four years old before she attempted to walk.

On admission into hospital, the child was pale, but well nourished, short for her age, with a small face, making the bones of her head appear larger than natural. The fontanelles had closed; no depressions could be felt along the course of any of the sutures of the skull. The child's upper teeth were imperfectly covered with enamel; her tonsils were so much enlarged as to meet in the median line of her throat. Her chest was narrow in front, the sternum prominent, and her ribs at the junction with the cartilages of the sternum presented well-marked nodular swellings; the sternal ends of her clavicles were enlarged, and also the extremities of the long bones of her upper and lower limbs.

Our patient was admitted into the hospital in consequence of the existing deformities of her legs, which were knock-kneed to such an extent that she could hardly walk from one bed to another; for, after placing her left foot on the ground, the knee bent so much inwards that she could not bring her right leg (affected in the same way) forwards. This was, in fact, a case of exaggerated genu-valgum, and, like many instances of the kind, the deformity was increased by weakness of the internal lateral ligaments of the knee-joint.

The patient's femurs were curved and distorted; but, on carefully examining the bones of her legs, we came to the conclusion that they were sufficiently soft to enable us to hope that we might bend them by means of mechanical appliances into a better position than at present.

A splint was made for the child, which was secured to her body by means of a plaster of Paris bandage, and extended down her thighs and legs somewhat like a Hamilton's splint. At the end of a month's time this splint was removed, and the child's legs and thighs were fixed in a leather case. She was ordered cod-liver oil and the lacto-phosphate of iron, and sent to Margate for two months. Under treatment of this kind her limbs improved wonderfully. It is now two and a half years since she came under my observation; though still knock-kneed, she can run and walk as well as any child of her age.

It is difficult to determine the earliest period of life at which symptoms of rickets may occur. Some authorities believe they have detected the disease at birth, but it may be laid down as a rule that this affection is essentially one of infancy and childhood, commencing any time from the fourth or fifth month after birth until the end of the second year. It manifests itself far less frequently as the child grows older, and may be said never to occur after a child has attained his seventh year.

It is, of course, quite possible that rickets, having been developed in early life, its progress may become arrested for a time, and then, from untoward circumstances, the disease may make more active advance; but instances of this description do not invalidate the rule above referred to. It is not, however, until the framework of the body is called upon to form a mechanical support to the trunk and limbs, or as a fixed point from which the muscles act as the child assumes the erect position, that we begin to detect the more obvious lesions produced by rickets on the bones.

In the first place, however, we may refer to the symptoms attending the development of this disease, for in this, as in many other affections, it is a matter of importance to detect the commencement of the malady. I shall subsequently draw your attention to the etiology of rickets, and, after giving you an outline of its pathology, conclude by referring to the treatment of the disease.

Mrs. R., when giving us the details of her child's case, stated that this infant, and also her brothers and sisters, as children, had suffered from profuse perspiration from the head and neck. This symptom is frequently present in the early stages of rickets. No sooner is the infant laid down to sleep in its cot than the perspiration commences to flow from the child's scalp, neck, and shoulders, so that the pillow on which he rests becomes absolutely soaked with moisture. At the same time the child is extremely restless, tossing his head about from side to side, throwing off the bed-clothes, and refusing—even on a cold night—to be covered with a light sheet. These symptoms do not appear to depend upon fever, as the thermometer shows no certain indication of a rise of temperature of the child's body.

The restlessness, in fact, seems to be caused by a general tenderness of the surface of the child's body, so that in whatever position he is laid, pressure on the part produces uneasiness if not actual pain. We notice the same thing when the child is being carried about, he appears to be unable to rest in any one position; the truth is, wherever the nurse's arms press on the surface of the infant's body, it produces pain, and so the child is said to be fractious, its irritability not uncommonly being attributed to a disordered state of the bowels. This idea is somewhat confirmed by the fact that, as in the case of Mrs. R.'s child, many infants affected with rickets suffer from chronic diarrhœa; the stools contain mucus, are acid, green, and frothy. This disordered state of the bowels, together with the profuse perspiration and restlessness, tend to weaken the patient, and he becomes anæmic; but, unless in severe cases of rickets, the child seldom seems to lose flesh, he is pale, fat, and flabby.

Supposing you were called to a case in which the above symptoms are more or less prominently marked, your suspicions would be at once excited as to the existence of rickets, especially if the patient is from five months to two years old, for, as I said before, this, as a general rule, is the time of life when the disease commences; and under these circumstances you would not fail to go farther into the particulars of the case, and the chances are you would meet with unequivocal evidences as to the presence of the affection we are now studying.

The first of these unquestionable symptoms of the disease is the enlargement of the ends of the ribs, at the line of their junction with the costal cartilages. They are beaded or nodulated, and when once you have felt the parts affected in this way, you will never be in doubt as to its existence or otherwise.

But it is well to bear in mind the fact that the swelling may occur principally on the inner surface of the ribs; nevertheless, if a careful examination of the thorax be made, especially over the extremities of the middle ribs on the left side of the chest, the nodulated condition of the bones will readily be detected even at the commencement of rickets.

I have already remarked that abnormalities in the bones are not so apparent in the earliest stages of rickets as they otherwise might be, because the functions which the skeleton has then to perform are of a comparatively subordinate nature; but there is an exception to this rule in the circumstances of the bones entering into the construction of the chest; the ribs must not only move, but resist atmospheric pressure from the first minute of life, and so it is in consequence of this movement and the resistance they are called on to exercise to the atmosphere, the soft parts of these bones, at their lines of growth, are pressed out and become bulbous. This beading of the ends of the ribs has been noticed, in children suffering from rickets, six weeks after birth.

Alterations in the condition of the occipital bone have been found in cases of rickets at a very early age, and they are almost as constant in this disease as abnormalities of the ribs, but they are not quite so easily detected.

In examining the occipital bone in instances of this kind, the child's head must be fixed, and the surgeon should then carefully press his fingers perpendicularly over the integument covering the occipital bone and posterior portions of the parietal. Should rickets exist, he will generally feel several small round or oval soft spots, situated within the sutural margins of these bones. These spots are unossified portions of the structures from which the bone is produced. The number of soft spots varies considerably; in some cases only one can be felt, in others as many as ten or a dozen; but I have never been able to satisfy myself that fresh spots of this kind have occurred after a child is a year old in those portions of the occipital bone which have once been calcified. I have mapped out these depressions with nitrate of silver, leaving the other portions of the bone uncovered, and I cannot say I have discovered soft spots making their appearance in those parts of the bone which have once become hard and firm.

It is a mistake to suppose that in this condition (known as cranio-tabes) the soft spots referred to are literally perforations in the cranium. In the instances I have had an opportunity of examining, the bone-forming elements fill the deficiencies in the bones intervening between the dura mater and the pericranium. The nuclei of the cells are seen encased in their soft hyaline surrounding, but into this homogeneous material they have failed to secrete any bone-earth; in fact, these spots are literally small fontanelles, and, as a rule, in any particular case they close about the same time as the larger fontanelle openings do.

Cranio-tabes is present in forty-five per cent. of all instances of rickets.

The occipital bone is often remarkably thin in cases of this disease. The sagittal and coronal sutures may remain open until the patient is eighteen months old; the two halves of the frontal bone sometimes continue ununited for a year after birth, and the anterior fontanelle may still be patent, although the child is four or five years of age. Our patient's head was of the peculiar elongated type so characteristic of rickets, the centres of ossification in each bone becoming developed and more prominent than the rest of the skull.

The frontal sinuses, like the bones of the face, are small in comparison with the skull, so that at the first glance we are apt to assume the latter to be larger than it should be; but such is not often the case in rickets. The proportions of the head and face in these cases are determined by the same developmental defect which prevails throughout the body, the skeleton retaining the infantile type, so that we might almost suppose the fœtal skeleton to have remained cartilaginous and grown in place of being transformed into bone; thus, the face remains small in comparison with the skull, and the thighs and arms are short as compared with the legs and forearms.

In connection with the alterations I have described in the bones of the skull, I may refer to disorders of the nervous system not unfrequently met with in rickets. These affections are considered by some authorities to depend upon pressure on the brain from without, through the soft spots observed in the occipital and parietal bones. For instance, one of E. R.'s sisters suffered from attacks of laryngismus; another sister had several fits of convulsions.

Laryngismus is by no means of unfrequent occurrence among children suffering from rickets; and, as the spasmodic attacks almost invariably come on at night after the child is laid down to rest, it is possible they may be occasioned by pressure upon the brain through the openings in the occipital bone. However this may be, it seems certain that there is a direct connection between the laryngismus and the rickets, and that, if the latter is overcome, the former may be cured; in fact, in instances of the kind we must direct our attention to the general ill-health of the patient rather than to the local manifestations of the disease in the larynx.

The same remark is applicable to the attacks of convulsions. In spite of much that has been written to the contrary, I am convinced that the practice of lancing the gums frequently relieves the pain and local irritation, which unquestionably exist in many otherwise healthy children during dentition. At the same time I readily admit that dentition may be delayed, and generally is so in rickets, and that in cases of this kind it can be of little use to lance the gums for relief of attacks of convulsions; but then we have clear indications to guide us with reference to doubts we may entertain on the subject; for, if the backward dentition and the convulsions are due to rickets, there will be the beaded ends of the ribs, open sutures and fontanelles, perspiration and restlessness, together with other symptoms pointing distinctly to the nature of the malady from which our patient is suffering.

While the changes I have described as taking place in the ribs and bones of the skull are progressing, the lower extremities of the radius and ulna frequently become swollen, and, in fact, bulbous enlargement of the ends of all the long bones is characteristic of the disease. This condition of the bones is evidently most readily detected in those parts of the body which are only thinly surrounded with muscular and other soft structures.

But I wish to draw your attention to these specimens of rickety bones. You will observe that while the epiphyses, or rather the extremities of this radius and tibia, are bulbous, the shaft of the bone is of its normal length and calibre. No doubt many bones affected with rickets are shorter than natural in consequence of the peculiar curve which they assume, their distorted growth being the most prominent and obvious effect of the disease. These distorted dense bones are as characteristic of rickets in after life as the soft pliable one is of the early stages of this affection.

It is impossible to lay down any hard and fast rules as to the time of life when the bones affected by rickets change from the soft into the hard condition.

In some instances calcification of the osseous tissue commences when a rickety child is four or five years of age; in others it is delayed until the tenth or twelfth year. It is important to bear this in mind, because so so long as the bones are soft it is always possible to overcome their contorted condition by mechanical appliances; when once they are calcified, but little can be expected from treatment of this kind. Nevertheless, the distorted bones of rickets frequently improve greatly as long as the child continues to grow, because the diseased action or cause of rickets usually ceases after the patient reaches his third or fourth year of age, but the laws governing the normal and symmetrical form of the body continue to exercise their supremacy over the abnormal condition, and so the bent bones have a tendency as they increase in size to assume their natural form.

In female children one of the most serious deformities that occur under these circumstances is in the bones of the pelvis, which continues throughout life, so that the opening through the brim of the pelvis remains contracted, and during parturition may seriously interfere with the passage of the head of the fœtus.

The upper and lower surfaces of the vertebræ are pressed outwards like the ends of the ribs in rickets. And from the weakness of the ligaments and muscles of the back, the natural curvatures of the spinal column not unfrequently become exaggerated; so that we meet with humped-backs and a still more serious curving forwards of the lumbar vertebræ in this disease, which occasionally makes its appearance somewhat suddenly, and bears considerable resemblance to that which results from caries. But in these cases the other signs of rickets will be clearly marked, and if the patient is laid on his back upon a flat hard surface, the curvature of the spine will almost disappear. Lateral curvature also takes place from weakness of some particular set of muscles; but caries of the spine, such as we so frequently see in tuberculous inflammation of the bones, is never due to rickets.

The thorax is often much altered in shape, as in the instance of E. R.; the ribs being abnormally straight between their nodules and angles, a sulcus is formed running along the side of the chest, beginning about the nipple; it increases in breadth as it passes downwards. The cartilages of the ribs are usually depressed, and there is a transverse constriction on a line with the xyphoid cartilage. As Sir W. Jenner remarks, if you wish to study the characteristic form of a rachitic thorax, you have an admirable example of it in children during a paroxysm of whooping-cough.

Our patient's eldest sister suffered from extensive disease of the heart; she had never had an attack of rheumatism, and it seems more than probable that the instances of cardiac disease met with in rickety children are usually due to the mechanical deformity of the bones of the thorax.

With reference to the internal organs of the body, with the exception of the enlarged spleen and lymphatic glands, we know of no abnormal changes which can be said to be in any way characteristic of rickets.

Before entering on a study of the pathology of this disease, so far as the bones are concerned, I may remark that rickets is in a great measure an affection attending the advance of civilization and the crowding of families into large cities. Thus nearly thirty per cent. of the children admitted into the Metropolitan hospitals are affected more or less with rickets. The same observation applies to the population of Manchester and other large towns in England; but among the children of our rural population rickets is comparatively rare. The disease, however, is not engendered by poverty alone, because the children of the upper classes suffer largely from rickets. On the other hand, if we turn from Europe to the population of India, I might almost say of Asia, we seldom (and so far as my experience goes never) meet with cases of rickets among the natives, however poor and degraded the race may be; in truth, the more debased the tribe, the nearer the lower animals in their habits, the less they are subject to rickets.

I argued in a former Lecture, on somewhat similar data, that concussions or injuries of the cancellated tissue of the bones in the neighbourhood of the large joints could hardly be the cause of the numerous cases of diseased bone we meet with in this country; for native Indian children, who are equally subject to injuries, very rarely suffer in this way, in all probability because they are less commonly affected with tuberculosis, living as they do night and day through the greater part of the year in the open air. Further than this, rickets is so generally preceded by diarrhœa, that some surgeons have supposed that the changes noticed in the bones are an effect of the disordered state of the bowels; but this cannot be the true pathology of the disease, because diarrhœa and dysentery, both chronic and acute, are the principal causes of death among the children of natives in India; but, as I have before remarked, they do not suffer from rickets.

There is, however, a marked difference in the system of rearing infants in India and in this country; the native mother, however poor or rich she may be, invariably suckles her own child; and both mother and infant exist night and day almost in the open air. Unless perhaps in the Presidency towns, no native would know the meaning of a feeding-bottle; very few of them have perhaps ever seen one. If they have not sufficient nourishment for their infants, the probabilities are that before long the little things die from inanition; for, until they can chew rice, they get nothing but their mother's milk to exist upon.

How different are the conditions of infants reared in our large cities! The history of the patient now before us is a case in point; the child lived in a polluted atmosphere without sun-light, and was fed on little more than bread and water (for we know what the milk supplied to the poorer classes of London consists of) until she was seven months old. It is true the infant probably had sufficient food, but it was food incapable of properly nourishing an infant.

Dr. Guérin, many years ago, sought to determine by experiments on animals whether rickets could be produced at pleasure. He took a certain number of puppies of the same litter, and after allowing them for some time to suck their mother, he weaned one-half of them, which he fed on raw flesh, a kind of nourishment, as M. Trousseau remarks, which might at first seem the most suitable for these carnivorous animals. In a short time, however, the puppies which had continued to take the maternal milk became strong and vigorous, while those which had been weaned and placed upon an apparently substantial diet, became weak and their limbs deformed. At the end of four or five months they presented all the symptoms of confirmed rickets. From these experiments Guérin and Trousseau drew the following conclusion :—"That rickets is in a great part dependent on disorders of the functions of nutrition, which is again dependent on feeding." While assenting to this fact, as I remarked when lecturing on hereditary syphilis, it is almost certain that the condition of the bones analogous to that of rickets may be induced by constitutional defects, through which the patient's digestive functions are at fault, and he is unable to assimilate his food, and it thus occasionally happens that although an infant is supplied with a sufficiency of milk by its mother, the child's blood nevertheless does not receive a sufficiency of earthy matter from which the bone-forming elements can build up a sound osseous tissue.

Lastly, the bone-corpuscles, as seems to be the case in syphilis and some other forms of inherited disease, although supplied with material necessary to the formation of healthy bone, are unable to accomplish their work, and so the symptoms of rickets are produced.

In this way we may explain the circumstances of those comparatively rare cases in which children who have been suckled by excellent nurses and reared under favourable circumstances become affected by this disease. In truth, rickets is a disease of nutrition, and not solely of dietetic origin. The soft bones characteristic of this malady may result from any cause which in infant life interferes with the action of the protoplasm of the body, particularly that of the bones, preventing them from performing their normal functions, as far as the growth of healthy osseous tissue is concerned.

Holding these views we may unreservedly assent to the proposition that there is something in the mother's milk almost essential to the perfect elaboration of the osseous system; and, if it is withheld from her infant, the consequences are, too frequently, rickets with all its complications.

No sooner is a rickety child able to masticate, and the glands of his stomach and intestinal canal fully formed, so that he can assimilate miscellaneous articles of food, than the blood takes up the chemical constituents necessary to hardening the medullary structure, and in by far the majority of cases dense bone is rapidly produced. The beading of the ribs and enlarged ends of the radius, tibia, and so on are due to the bulging outwards from pressure exercised on the soft extremities of the bones. The remarkable curvature of the bones in rickets is the result of the same cause—that is, mal-nutrition.

It does not seem to be at all improbable that parents having suffered from rickets may transmit a tendency to the disease to their children; but there can be no question that if the children of parents who have had rickets are properly fed, and live in pure air and light during infancy, they grow up, as a rule, to be strong and healthy. Rickets is not an hereditary disease in the ordinary sense of the term; nevertheless, we must bear in mind the fact that, during the existence of the fœtus in utero it depends for its nourishment upon its mother. Consequently, if a woman has children rapidly one after the other, or suffers from continued sickness during pregnancy—in fact, if from any cause she is prevented from furnishing a proper supply of the ingredients necessary to build up a healthy fœtus, she may engender a condition of rickets in her child before it is born; this condition is subsequently augmented by the want of an adequate supply of healthy mother's milk and pure air.

Pathology.—With reference to the pathology of rickets, as it affects the bones, their condition varies with the stage of the malady. At first the bones are soft and pliable, so that they can be bent like a piece of cartilage; subsequently they become dense and hard as ivory. If we divide a rickety bone longitudinally during the first stage of the disease, we notice that the medulla filling the central canal and cancellated tissue is of a crimson colour and jelly-like consistency. This soft medulla is especially abundant at the line of junction between the diaphyses and the epiphyses.

On examination, we find that the medulla of a child suffering from the first stage of rickets consists of a vast number of round cells, compound cells, and fat; the adenoid tissue and vessels are normal in appearance; in fact, the elements characteristic of healthy medulla are present in the bones of infants suffering from rickets, but in this disease there is an imperfect formation of the calcareous skeleton of the bones, and in its place we find an excess of medullary tissue. I have been unable to detect any abnormalities in the histological relation of the elements constituting the medulla in cases of rickets; the malady, so far as the bones are concerned, depends on the deficiency of earthy matter contained in their hyaline matrix—a fact which has been demonstrated by the chemical analysis of rickety bones during the early stages of the disease.

If we examine sections made through the epiphysis into the diaphysis of bones affected with rickets during the first stage of the disease, we find at the line of ossification (Fig. 3) numerous villous-like processes of medulla, projecting, as it were, from the diaphysis into the epiphysial cartilage. These processes, however, are not formed from the growth of the medulla of the diaphysis into the cartilage, but from a transformation of the cartilage-cells of the epiphysis into medullary tissue at the normal line of ossification; the cells of the outer layers

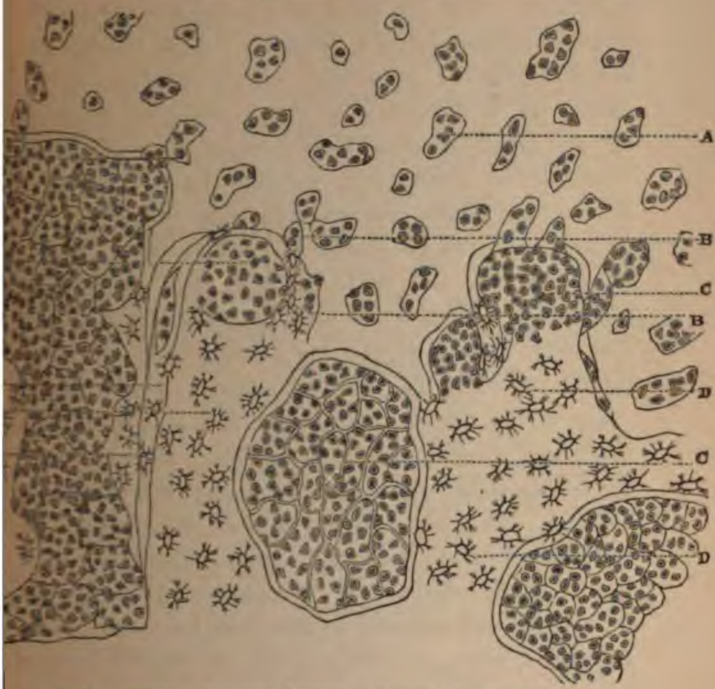

Fig. 3.—Section through Articular Cartilage and subjacent portion of Bone in a Case of Rickets.

A, Cartilage-cells.

B B B B, Cartilage-cells being absorbed into the spaces of the cancellated tissue of bone where they constitute a portion of the round cells of the medulla; some of these cells are being transformed into bone-corpuscles.

C C, Medullary structure in cancellated spaces.

D D, Bone-corpuscles of trabeculæ.

of these processes afford us some remarkably good specimens of the transformation of cartilage into bone-corpuscles. But the mass of the descendants of the cartilage-cell forming the processes I have referred to, are incapable of producing healthy bone in consequence of a deficiency of the bone-earth. So long as an infant is insufficiently supplied with, or is incapable of assimilating, elements necessary to the calcification of the cartilage-cells, it is impossible that healthy bone can be produced. But we must bear in mind the fact, that while in rickets our attention is prominently directed to the condition of the bones, the other tissues of the body are hardly less injuriously affected by the mal-nutrition which is the cause of the disease, and so we find that weak ligaments and muscles are no insignificant factors in the production of the knock-knees or bandy-legs of rickety children. If a badly-nourished child of this kind be constantly carried upon its nurse's right arm, in consequence of the habitual position which the infant assumes his left leg will probably be rendered bandy, while his right knee, falling into the hollow of the left, will become valgus. Mr. E. Owen, of St. Mary's Hospital, has, in some lectures which he has lately published, clearly demonstrated the important part which weak ligaments play in the formation of genu-valgum; and on account of the yielding of the inner ligaments of the ankle and knee, spurious talipes-valgus and genuine genu-valgum are constantly found associated in the same limb. When once the internal lateral ligaments of the knee-joint have become stretched in the case of a rachitic infant, the head of the tibia is deflected outwards, and the pressure which it naturally exercises is removed from the inner condyle of the femur; the consequence is, that the soft bone forming the inner condyle grows more rapidly than it should do, and subsequently, when ossification occurs in the part, this condyle is so much larger than the outer one that the tibia cannot assume its normal position, and genu-valgum is the result. So that you understand this deformity, like others connected with rachitic bones, depends on abnormalities which the bones assume in the first, or soft, stage of the disease; the irregularities which they then take become permanent as the deformed bones are subsequently calcified.

Treatment.—From the account I have given you of the nature of rickets, it is evident, before commencing any line of treatment, you must ascertain the cause, or causes, which have engendered the mal-nutrition upon which the disease depends. In some cases the family history may lead you to suspect that a syphilitic or scrofulous taint has affected the healthy action of the living protoplasm, rendering it unable to perform its healthy functions, but in a far greater number of rachitic children the disease undoubtedly depends upon an insufficient, or improper, method of feeding the infant, aggravated by an insufficiency of clothing and an impure atmosphere. Our treatment must be directed towards overcoming these defects, and as Dr. Parry, of Philadelphia, argues, if we recognize the affection in its early stages, and insist on the patient being properly clothed and judiciously fed, the symptoms from which he has been suffering in by far the larger number of cases will disappear.

It may be impossible, especially among the poor, to provide a healthy wet-nurse, but much may be done by careful directions as to the infant's diet; and, in addition, by ordering cod-liver oil and the lacto-phosphate of iron. It is surprising how speedily a rickety child improves under treatment of this kind.

I dwelt at greater length than might have seemed necessary on the symptoms indicating the commencement of rickets; but you will now understand the peculiar importance of appreciating the circumstances attending the onset of the disease, for if you appreciate these in their early stages, and apply treatment based on the principles above indicated, you may generally cure the malady.

Supposing, however, the child has grown out of the first stage of rickets, and you are consulted regarding the deformities resulting from the abnormally soft condition of the bones, the question must arise, what are you then to do? As I have before remarked, a child's age is no criterion as to the state of the osseous structures. In some cases of rickets the bones remain soft until the patient is eight or ten years old; and so long as this is their condition, you will evidently endeavour to straighten the distorted limbs, and keep the child from bearing the weight of his body upon them, administering, at the same time, lactate of iron and phosphorus, cod-liver oil, milk, and attending to his general health.

In cases where the curvature of the limbs is very great, and the bones have already become hard, it is wonderful how much they sometimes improve in the course of a few years, aided by mechanical appliances and careful treatment.

Rickety children frequently grow up to be powerful healthy individuals, so that I would, as a rule, limit any operative proceedings in rickets to those instances in which the abnormal condition of the bones is so great that the child is unable to walk with ease. If he cannot walk with comfort to himself we are unquestionably justified in the case of children (not among adult patients) in dividing the curved bones or in excising a wedge-shaped piece out of them, so as to straighten the distorted limb.

Dr. T. F. Chavasse, in reviewing this subject, remarks that the operations as practised at the present day for the relief of genu-valgum are: (1) Osteo-arthrotomy; (2) Osteotomy; (3) Subcutaneous fibrous section; (4) Forcible straightening. The first is known as Ogston's method, and is done by flexing the knee as fully as possible, then inserting a long tenotomy knife flatly, two or three inches above the tip of the internal condyle, pushing it downward, forward, and outward, until the point is felt in the inter-condyloid space. The cutting edge of the tenotome is then turned downward, and the soft tissues are divided to the bone as its withdrawal is effected. Adams's saw is now inserted and directed along the canal which has been formed, and the inner condyle is sawn through from above downward for about three-quarters of its thickness. By forcibly straightening the leg, the fracture of the partly-detached condyle is completed, and the limb brought into proper position by the loose condyle slipping upon the sawn surface of the shaft. The after-treatment is simple.

Macewen, of Glasgow, and Chiene, of Edinburgh, lay claim to the operation by osteotomy, *i.e.*, the removal of a wedge-shaped piece of bone from the femur above the line of epiphysial union. Macewen takes a point half an inch above the upper border of the patella, while the leg is in a state of extension, makes an incision just in front of the tendon of the adductor magnus, reaching the femur at one cut, the length of the wound being about three-quarters of an inch, and then divides the shaft of the bone for the inner two-thirds of its thickness by three chisels, the largest of which is used at its commencement: thus a wedge-shaped opening is produced without removal of osseous material. The remaining outer third of the shaft of the femur either snaps or bends when the leg is straightened.

Langenbeck stands first among those advocating subcutaneous fibrous section. He divides the external lateral ligament. Billroth divided the external ligament and the tendon of the biceps, while Reeves has divided, in addition to the above, the fascia lata.

The Lyons School, and especially M. Delore, recommend *forcible straightening*. It is carried out by placing the subject on the back, and after administering an anæsthetic freely, by main force with the hands and knees of the operator, bringing the leg into the normal position; this, if effectual, is accomplished by a series of cracks.

Dr. Chavasse gives the arguments *pro* and *con* for the different operations.

The chief objection to osteo-arthrotomy is the involvement of the joint. No operation can be a safe one that involves the articulation. Ogston's, Reeves', and even Chiene's, which professes to be a pure osteotomy, have all been proven to implicate the articulation, and are hence attended with more or less danger.

Mr. Macewen has, however, operated on 557 limbs, belonging to 330 patients, affected with various osseous deformities of the lower extremities. Of these, 220 patients were affected with knock-knee, presenting 367 limbs for treatment; there were 104 bow-legged limbs; 80 suffering from anterior curvature of the tibia. In some of these cases where the knock-knee was complicated with curves of the tibia and fibula the condyle of the femur, as well as the bones of the leg, were divided at one operation. For bow-leg the tibia and fibula were not unfrequently divided in more than one place, so as effectually to straighten the limb. As many as ten osteotomies were performed at one sitting. The wounds in the skin were made sufficiently large for the osteotome to reach the bone, the cases all being treated antiseptically. Of the above patients three died after the operation; but as Mr. Macewen observes, these deaths cannot be said to have been caused by the operation.

Results such as these are most encouraging; nevertheless, my own experience obliges me to counsel you not to undertake operations for deformities such as I have referred to unless the condition of the limb interferes with locomotion, and the patient has not reached the adult period of life.

It would be beyond my province in a course of clinical lectures on diseases of bone to do more than briefly glance at the surgical proceedings necessary in instances of the kind; in fact, almost every case will require manipulation according to its special deformity. The same remark applies to the mechanical appliances to be made use of in the earlier stage of rickets when the bones are soft, and may be moulded into something approaching their natural form—always bearing in mind the unquestionable fact, that, under well-regulated diet, cod-liver oil and iron, many unpromising cases of rickets greatly improve; and unless these matters are scrupulously attended to, mechanical appliances, however ingenious they may be, will hardly succeed in overcoming these deformities in the first, or soft, stages of the disease.

The fact cannot be too strongly insisted upon, that the distorted bones we so often meet with in connection with rickets are often the result of negligence on the part of parents, and, not unfrequently, of the medical practitioner in charge of the case. It is precisely the same thing with the various deformities of the foot, known as talipes-valgus, varus, and so on. It is impossible to doubt the statement that infants suffering from the worst deformities of this description may be cured by means of well-applied straps and bandages, but the longer the patient remains unrelieved the more difficult it becomes to overcome the mal-position the foot has assumed. And so with rickets, if, as soon as symptoms of the disease manifest themselves, the patient is properly treated upon hygienic principles such as I have described, and at the same time if the yielding bones are straightened, supported, and relieved from undue pressure, we should seldom meet with the deformities which are now of such frequent occurrence in instances of this disease.

LECTURE VIII.

HYPERTROPHY—HYPEROSTOSIS—DIFFUSE SCLEROSIS OF BONE.

Hypertrophy of Bone.—In discussing affections of bone, as in other matters, if possible call things by their correct names, and so consider hypertrophy of bone as an irregular or increased growth of a definite portion of the osseous tissue. If the elements entering into the formation of the enlarged bone are abnormal in their relations to one another, the case is no longer one of hypertrophy. For instance, I may refer to this specimen of the lower end of the femur, taken from the knee of a girl who had suffered some years before from disease of the joint, caused in all probability by an abscess which had formed in the popliteal space, and burrowed into the joint, leading to the destruction of the articular cartilages and ligaments. The upper end of the tibia was drawn backwards by the hamstring muscles, and the lower articular surface of the femur having been relieved from the pressure which in health would have been continually exercised on it by the tibia, has become hypertrophied. The osseous structure in the excised portion of the bone is normal in character, but there is more of it than existed in the corresponding part of the other limb.

From a clinical point of view this specimen teaches us an important lesson, which is, that under circumstances such as those above-mentioned the end of the femur may become enlarged, and we can therefore readily comprehend the reason why we sometimes experience difficulty in rectifying the mal-position of the limb produced by old-standing disease of the knee-joint. We may divide the tendons of the ham-string muscles and bands of contracted fascia, and break down the anchylosis which often exists in cases of the kind, and thus for a time bring the ends of the tibia and femur into apposition, but our efforts fail in keeping them there, and the leg gradually reverts to its flexed position on the thigh, the truth being that the condyles of the femur have become hypertrophied or enlarged anteriorly, and until we remove this impediment to the tibia resting in its natural position against the femur, it is impossible to prevent the tibia from slipping backwards. Under these circumstances it is sometimes necessary to get rid of the overgrown portion of the condyles of the femur, as in the following case, an abstract of which I give you from notes kept for me by Mr. J. Hipburn.

W. A., aged six, admitted into hospital on May 14th. This lad's parents are alive and in good health; his brothers and sisters, three in number, are strong and well. About three years ago the patient fell and injured his right knee; within a month's time of the accident an abscess formed in or about the joint, which continued to discharge for upwards of four months, and during this period the child's leg became gradually flexed on his thigh, and was ultimately fixed in the position in which we saw it when he was admitted into hospital. All active disease had then subsided for nearly two years; the leg was fixed and flexed at an obtuse angle on the thigh. On May 21st the patient being under the influence of anæsthetics, the tendons of two of the ham-string muscles were divided, but it was found impossible to bring the tibia into a straight line with the femur in consequence of the enlargement of the anterior part of the condyles of the latter bone. Under these circumstances an opening was made through the soft structures above and to the outer side of the external condyle, and a narrow-bladed saw having been introduced through this incision, the anterior part of the condyles of the femur was sawn through from above downwards, as recommended by Ogston for division of the internal condyle in cases of genu-valgum; in this instance, however, the anterior portion of the lower end of the femur was divided, and then, by forcing the tibia against the femur, the protruding portion of its extremity was thrust upwards on the shaft of the bone, after which there was no difficulty in extending the leg on the thigh. A plaster of Paris bandage was applied round the limb after the operation; and in two months' time the patient could stand firmly on his right leg, bringing the sole of the foot flat to the ground; he left the hospital perfectly cured, with the exception of having a stiff knee-joint.

In other cases where hypertrophy of the anterior portion of the condyles of the femur has occurred only to a slight extent, it is sufficient to divide bands of tissue which have formed round the joint, and to cut through contracted tendons in order to straighten the fixed and flexed knee.

As a case in point, I may refer to the history of E. B., aged eighteen. From notes kept by Mr. Butler, it appears that when two and a half years of age the patient fell and injured her left knee. She was subsequently under treatment for a lengthened period in several of the London hospitals, and ultimately was admitted into Westminster for the purpose of undergoing the operation of excision of a portion of bone, by means of which her leg might be extended and rendered useful, for she was unable to put her foot to the ground.

When I first saw E. B., her left leg was fixed at an obtuse angle on the thigh, the patella and joint were almost immovable, and the anterior part of the condyles of the femur was slightly enlarged. I had the patient brought into the theatre, and, with Mr. Pearce Gould's assistance, the contracted tendons and fascia in the popliteal space were divided, and the adhesions having been broken through, the leg was brought into a straight line with the thigh, and secured there by means of splints and bandages, without any difficulty.

The result has been very satisfactory. There has been no tendency for the leg to be drawn backwards, and if the condyles of the femur were enlarged, they have not prevented the adaptation of the head of the tibia to the end of the femur, so that the patient can use her leg and walk about with perfect ease.

One of the principal objections to dividing subcutaneously contracted tendons and fascia in the popliteal space is the danger of cutting through the external popliteal nerve, and so paralysing some of the muscles of the leg. To avoid this accident, which has happened in more than one of my own cases, I now make a point of dissecting out the tendons and structures to be incised. If this operation is performed under the carbolic spray and antiseptic dressings, it excites no more irritation than if the tendons were cut subcutaneously.

Another example of hypertrophy of bone produced by a deficiency in the controlling, or compensating, pressure of other parts, which in health limits its growth, is to be found in the baker's knock-knee, more frequently met with in Germany than among Englishmen. Professor E. Wagner remarks of this form of genu-valgum that it occurs "through excessive growth of the internal condyle of the femur; this arises from want of resistance exercised from the corresponding portion of the tibia during standing for hours at a time with bent knees." In this way also we explain the excessive growth of a tooth in one jaw, when the corresponding tooth in the other jaw has been removed.

I have here the skull of an adult patient, who in childhood suffered from rickets. The inner and outer tables of this cranium are somewhat thickened, but not unduly so in proportion to the space occupied by the diploë, which is evidently far greater than it would have been in a healthy bone. The skull is unquestionably very much thicker than it ought to be, but its histological elements bear their normal relation to one another; in other words, the bone is enlarged or hypertrophied.

In this instance, during early life the bone-producing cells were insufficiently supplied with the elements necessary for the construction of healthy osseous tissue; the medulla therefore grew apace, unrestrained by the pressure of any bone-shell around it. After a certain period of life, however, a more healthy process of nutrition was established in the part, and the superabundant medulla manufactured this thick skull, which was built up in accordance with the laws governing the development of healthy bone. The abnormal action was, in the first place—that is, in the primary stage of the disease—due to an overgrowth of the soft bone-forming elements of the part, unrestrained by the pressure of well-formed osseous tissue around it, and subsequently to the deposit of bone-earth in this superabundant medulla, by which the deformed bone became hardened or calcified.

Hypertrophy of bone, like that of other parts of the body, is sometimes met with as a result of perverted growth. One or more limbs may increase in size more rapidly than the corresponding parts on the other side of the body. In these cases there is no history of nerve-lesion, or, in fact, of any cause explaining the abnormally rapid growth of the limb, which, as a rule, has existed from birth, but may not have been noticed until a child reaches his eighth, or even twelfth year. It is probable that, in cases of this kind, the fault lies in the nerve-centre controlling the growth of that particular part of the body which has become hypertrophied. In consequence of this fault of development a part, or the whole, of one of the limbs grows more rapidly than the rest of the body. For instance, the right leg of a lad, twelve years of age, may be as big in every respect as his left leg will be when he is sixteen years of age. These cases may be considered as instances of hypertrophy, because the enlarged member, or part, is not only larger than that of the opposite side, but is also bigger in proportion to the rest of the body; its nerve-supply is natural, the bones, muscles, and in fact the whole of the limb, being, as a rule, proportionately enlarged. As the child grows, the disproportion between the enlarged limbs and the rest of the body generally becomes less marked; in fact, the action of the faulty nerve-centre becomes co-ordinated to the rest of the body, and the abnormal growth of the limb ceases.

Hyperostosis differs from hypertrophy in that the partial or entire increase in size of the affected bones does not consist of normal osseous tissue, considered histologically; but in hyperostosis the elements entering into the formation of the enlarged bones deviate more or less from that of healthy bone. In a case of general hyperostosis in which the patient, a man, sixty years old, had been affected for twelve years with enlargement of all the bones of his body, and ultimately died from asphyxia through disease of the ribs, Dr. Goodhart found the surface of the bones porous, with a singular mortar-like appearance; the periosteum was normal, but the bone was pink throughout, and firm and heavy, much softer than healthy bone. The bones were all enlarged, the left clavicle, for instance, being two and a half inches in circumference, with hardly any medullary cavity, and no cancellous tissue. The femur weighed 2 lbs. 14 oz., and was from six to eight inches in circumference. The microscope showed that the diseased bone had undergone considerable change. The Haversian canals were enlarged and irregular in shape.

This case presents features in common with a remarkable instance of general hyperostosis brought to the notice of the Medico-Chirurgical Society, by Sir J. Paget. In this instance one of the patient's sisters "died with chronic cancer of the breast." The patient remained in good health until he was forty-six years of age; he then began to be subject to aching pains in his thighs and legs; his shins became misshapen, broad, nodular, and uneven, as if not only the bones, but the periosteum and integuments over it were thickened. In the course of time the tibiæ became curved anteriorly. Subsequently the femurs, pelvis, and ultimately his skull, became much enlarged: for instance, his head, in 1844, measured 22½ inches, in 1876 27¼ inches; in its enlargement, however, the head retained its natural shape. The spine became slowly curved and rigid, the chest contracted and narrow. He died at the age of sixty-eight. Nearly all the bones of his body had been more or less affected. The disease had existed for some twenty-two years, when the patient died from pleural effusion. After death numerous small nodular masses of pale cancerous substance were found scattered in the lungs; others were seen growing from the affected bones. As a general rule, the outer surface of the bones was nodular, the compact substance in every part was increased in thickness, and Mr. Butlin reports that the Haversian canals were diminished in number, and enormously widened; many of them were confluent, and filled with an homogeneous or granular basis, containing cells of round or oval form about the size and having the appearance of leucocytes. Large nucleated cells were also present, and fibres, or fibro-cells, sometimes in considerable quantities.

A third case of the kind was lately brought to the notice of the Pathological Society by Dr. Cayley. The patient was a man, sixty-five years of age, in whose family history there was nothing pointing to cancer.

When he came under Dr. Cayley's care he was much emaciated, and his skin was studded with the small nævi, described by Mr. de Morgan in association with cancer. The tibiæ were curved and enlarged, but not painful nor tender; and there was general uniform enlargement of the lower jaw, and protuberance of the right parietal bone. The patient dying from dyspnœa, the right lung was found to be shrunken and carnified, the pleural cavity obliterated, cancerous masses occurring in the lung and pleura. The liver also contained some cancer nodules, but in no other part was cancer found. The gastric mucous membrane was atrophied. Each tibia was greatly increased in circumference, the increase being in great part due to overgrowth of compact tissue, although the medullary cavity was large, and filled by pale, gelatinous marrow. The compact tissue was light and porous. The fibula was not enlarged, and hence the excurvation of the tibia. The lower jaw was uniformly enlarged, both as to its rami and body, and it was almost edentulous. One of the bicuspid teeth, lodged in a carious cavity, presented curious nodulation of its crusta petrosa. The bones of the calvaria, especially the right parietal, were increased in thickness and very porous in texture. The left clavicle had undergone a similar change.

On a future occasion, when speaking of osteo-malacia, I shall endeavour to explain to you the nature of the morbid changes which sometimes lead to softening of the osseous tissue. In instances of general hyperostosis, such as those now referred to, possibly, at a certain stage of the disease the affected bones undergo a process of softening, which, if it were continued, would lead to incurable osteo-malacia. But, in the instance of hyperostosis under consideration, the morbid action going on in the medulla, which brought about the softening of the bone, has not entirely destroyed the bone-forming cells, and so new bone has been produced in larger quantities than in health; because, during the process of softening, the medulla has been partially unrestrained in its growth by the diminished resistance of the surrounding calcified osseous structure, and thus, when the medulla occupying this soft bone was enabled to perform its normal functions, it built up a large quantity of new porous bone such as we see in this specimen. It seems to me that we can only account for the deformed condition of these tibiæ by assuming that at some stage of their life they have been pliable, yielding, as in rickets, to muscular force or to the weight of the body; but the gradually increasing size of the bones points to the fact that one part of the osseous tissue after the other became implicated, as also did one bone after another of the skeleton become involved in the diseased process.

The deep-seated pain in the limbs, tottering gait, and other symptoms described by Sir J. Paget as existing in his case of general hyperostosis, remind us very forcibly of the characteristic symptoms of osteo-malacia; so much so, that we are hardly surprised to find the condition of the medulla recorded by Mr. Butlin, as existing in the case above referred to, corresponding with the microscopical appearances presented by sections which I have made through the bones of a patient who died from osteo-malacia, the result of sarcoma. The idea that there is some connection between the condition we call general hyperostosis and osteo-malacia is confirmed by the further clinical histories of these diseases. For instance, we had lately a case in the hospital of a woman, Mrs. L., aged fifty-six (Chadwick ward), suffering from a large osteo-sarcoma of twelve years' standing, growing from the upper end of the right humerus. Within the last two years she has complained of deep seated pain in her lower extremities; both tibiæ are enlarged, and the right shin-bone, as my patient remarked, "was becoming much bowed." So that the lengthened course of the disease in Sir J. Paget's case does not appear to militate against its having been sarcomatous, perhaps of the same description as that which killed his patient's sister, for she died of "chronic cancer of the breast."

It seems to me, therefore, that some of the specimens of hyperostosis which we meet with in our museums are instances of osteo-sarcomata, single bones only having been preserved; or it may be, the patients have died from some other cause before many of the bones were implicated in the diseased action. But although I think that general hyperostosis is perhaps sometimes due to sarcoma, and that its various forms, designated as either porous or hard hyperostosis, are simply modifications of the same morbid action, it is quite certain that local enlargement of the bones may occur under very different circumstances—for instance, in syphilis the osseous forming-cells of the periosteum are more frequently involved than that of the medulla, and so give rise to local and sometimes extensive hyperostosis of the bones. In cases of this kind the history of the disease will guide us to a correct diagnosis regarding the malady.

But there are other cases of hyperostosis in which it seems probable the abnormal growth from the periosteum may be induced through perverted nerve-action, influencing the nutritive changes going on in the part. There are several remarkable specimens of periosteal hyperostosis preserved in our London museums, one side of the skull and bones of the face being enormously enlarged over an area supplied by various branches of the fifth nerve; but as we should have expected from the anatomy of the osseous tissue, the abnormal growth, in instances of the kind, is confined to the periosteum, for the medulla being sparingly supplied with nerves is hardly involved, unless through the mechanical interference with its nutrition produced by the changes occurring in the periosteum.

I would therefore assign, as one cause of general, or widely-disseminated hyperostosis, a condition not far removed from that of sarcoma.

Local hyperostosis, in contradistinction to tumours of bone, is, as a rule, due to syphilis, chronic rheumatic arthritis, to injuries of the bones, or, lastly, in some exceptional instances, it may be caused by nerve-lesions leading to alterations in the nutrition of a limited area of the periosteum and bone.

DIFFUSE SCLEROSIS OF BONE.

By the term sclerosis of bone we mean that the part affected has become abnormally dense in consequence of changes that have occurred in its physical structure. Under certain circumstances we know that living bones become exceedingly hard, so that on attempting to cut them with a saw or chisel, we have to work through structures which remind us more of ivory than anything else; and if you make sections of a bone affected in this way, and grind it down for microscopical purposes, you will find that it requires patience to accomplish your end. The chances are that just as you have made a sufficiently thin preparation for examination by means of transmitted light, and you are giving it the last touch, it breaks into several pieces; and so you learn by experience that whatever the changes which have taken place in the bone, it has become harder and more brittle than healthy bone should be. I wish, however, on this occasion, to draw your attention to an affection in which the entire or greater part of one of the long bones becomes heavier and denser than natural.

This condition of bone is described by Billroth as *diffuse hypertrophy*, or *condensing ostitis.*

We have lately been engaged in considering some of the diseases depending upon abnormal conditions of the medullary or soft structure contained in bone, but we must not overlook the fact that there is a large quantity of organic matter entering into the composition of the osseous tissue beyond that which is enclosed within its medullary and cancellated spaces; for as you know, the form and size of a bone are retained after its inorganic matter has been removed by means of dilute hydrochloric acid. The hyaline matrix of the bone which remains is formed from the cells contained in embryonic cartilage. The nuclei of the cells secrete bone-earth from the serum of the blood, becoming encased in a shell of earthy matter.

In a specimen of healthy bone, the lacunæ and canaliculi occupy hardly less space than the material in which they are situated, so that, if from any cause the bone-cells and the canaliculi become filled with organic and earthy matter, the portion of bone affected in this way must be harder and denser than the original bone in proportion to the amount of materials which have been deposited in the part; at the same time, any given weight of bone which has undergone changes of this kind may contain its normal proportion of inorganic and organic elements; its density is increased, but not the relative quantities of its chemical constituents.

Dr. Stark demonstrated the fact many years ago, that "the hardness of bone does not depend upon the amount of earthy matter it contains; the difference in hardness and sponginess depends on its physical structure." This is precisely the conclusion we have arrived at from an examination of specimens of sclerosed bone we have here. Thanks to Dr. Dupré, we have evidence regarding the relative proportions of the elements contained in these bones. Our Professor of Chemistry informs us that they are composed of—

Inorganic matter insoluble in water ...	50·13
Inorganic matter soluble in water ...	·96
Fat	5·50
Other organic matter	32·97
Water	10·44
	100

Consequently, although these specimens of bone are sclerosed, they nevertheless yield, in a given weight, elements in the same relative proportion as healthy specimens of bone.

From a microscopical examination of this tibia, I find that its canaliculi are almost completely obliterated, and by far the greater proportion of its lacunæ are diminished in size: at the same time the Haversian canals are hardly altered in calibre (see Fig. 4), so that we can understand how the blood circulated through the bone and kept it alive, although it is changed in structure throughout the entire length of the shaft. So long as it remained *in situ*, this hard, diseased mass of bone was a source of great disturbance to the nutrition of the surrounding parts, as the following notes, taken for me by Mr. Jaquet, demonstrate :—

J. C., aged ten years, had enjoyed good health until the disease of the leg came on, for the treatment of which he was admitted into the Westminster Hospital.

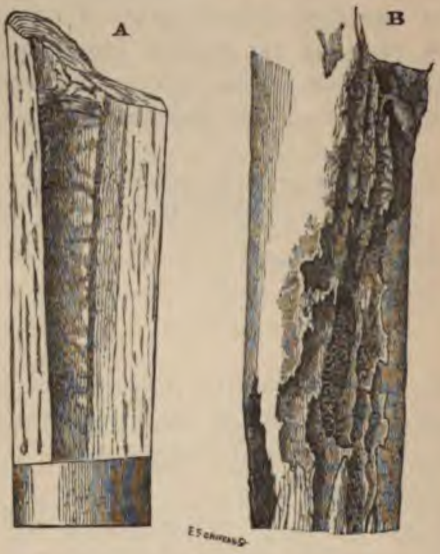

FIG. 4.

A. Section of tibia, taken from the bone removed in a case of *diffuse sclerosis*, showing its compact dense structure, smooth outer surface, and open medullary canal, as compared with B, a portion of the tibia removed from the leg of a patient suffering from acute osteo-myelitis (p. 42), showing the destruction effected within the shaft of the bone, together with a portion of its outer layers, which are comparatively healthy.

Some five months before, he began to complain of deep-seated pain in his right leg.

On admission, the lad was suffering from fever, and great pain in the right leg, which was swollen from the knee to the ankle. I made an incision into the soft parts, but on passing my finger through the wound could discover no bare bone; on the contrary, the periosteum was apparently unaffected. The pain increased, and a considerable quantity of matter constantly passed from the wound; it was evidently necessary to take further steps to relieve our patient from the pain and constitutional disturbance under which he was suffering.

On June 15th, an Esmarch's bandage having been applied to the leg, an incision was made along the inner surface of the tibia, and the condition of the bone was carefully examined. The periosteum was thicker and more opaque than it should be, and on cutting through it it was very readily separated from the bone. The surface of the tibia presented much the appearance of ivory; on attempting to pierce it with a hand-drill, I found it was intensely hard, and I came to the conclusion that the tibia was sclerosed and so determined to remove the shaft of the bone, leaving its upper and lower epiphyses and the periosteum in the leg. Considerable difficulty was experienced in cutting through the tibia, which was exceedingly hard, confirming my idea regarding the nature of the disease.

From the time of the operation the discharge of pus lessened, and the patient's health rapidly improved; new bone was thrown out from the periosteum, and in three months' time the boy left the hospital for the country. I saw him again in December, when he was able to walk about the wards, a mass of firm bone having formed in place of that which I had removed.

In the case of J. C., the shaft of the bone presents no evidence of inflammation in the medullary tissues. On the other hand, the soft structures contained in the central cavity of the bone were healthy. On making sections through it we discovered that by far the larger number of the canaliculi had disappeared, and the lacunæ were smaller and more numerous than in health, so that any given portion of the shaft of the tibia was only about half as porous as a healthy specimen of bone would have been; and, in sawing through it or grinding it down, the force required to effect our object was in excess of that necessary to operate in a similar way upon sound bone, to the extent of the resistance offered by the surplus quantity of inorganic matter or bone-earth which it contained.

It is difficult to explain the nature of the abnormal action which, in the class of cases we are considering, produce this silting-up of the pores in this tibia, leading to changes in the physical structure of the bone; but sufficient blood evidently continued to flow through the vessels contained in its Haversian canals, and to some extent through the canaliculi and the lacunæ to keep it alive; otherwise the bone would evidently have died *en masse.*

We know, as a matter of fact, that sclerosed bone may live for years—a constant source of irritation and trouble, as the following case demonstrates:—

C. B., aged twenty, was lately in Holland ward, under Mr. Cowell's care. There was no evidence of hereditary disease in her family. When young, the patient met with an accident by which she injured her right leg, and from that time up to the present the limb has been a source of almost constant pain and trouble, so much so that she has been a cripple for some years past. On admission into hospital, the right tibia was found to be somewhat thicker than that of the left leg, the superficial structures were covered with ulcers and their cicatrices, and there was constant and most severe pain in the limb, but the periosteum covering the tibia was entire, and no necrosed bone could be detected.

After long-continued treatment, Mr. Cowell considered it advisable to amputate the leg at the knee-joint. Subsequent to the operation the patient rapidly recovered her health, and soon left the hospital able to walk about on her wooden leg.

The tibia was covered with periosteum; the surface of the bone was smooth. On making sections through it, we found it was sclerosed from one end to the other, the trabecular network of its extremities being implicated to as great an extent as the shaft of the bone, but the medulla was apparently healthy, and the Haversian system and the nutrient artery have been completely injected through the popliteal vessel.

On examining sections made from the shaft of the bone, we found that the canaliculi were almost obliterated, its lacunæ being greatly diminished in number and size. In this, as in the former case, we can therefore easily understand how it is that the bone continued to live, and we can also comprehend the fact, that a heavy hard mass of diseased bone such as this was a perpetual source of pain and irritation to the patient.

We may presume that this sclerosed state of the tibia had, in this instance, existed for years; nevertheless, as the child grew, her diseased bone continued to increase in size, because its medullary structure and periosteum had remained comparatively healthy, the perverted action principally occurring in the organic matrix of the bone.

You are aware that sclerosis of bone occurs in cases of rickets, syphilis, and many other affections, in which the appropriation of the elements contained in the blood by the bone-cells is greater than is required for the maintenance of the healthy condition of the structures through which they flow; but in the class of cases we are considering, it is impossible to determine if the fault originates in the cells, by means of which the integrity of the affected tissue is affected, or if the defect occurs in the blood supply.

It would certainly seem that diffuse sclerosis of bone sometimes takes place in consequence of the circulating fluid, like an overflowing stream, depositing its inorganic elements in all the available crevices and channels through which it passes, silting up the pores which are contained in the osseous structure; and so any cause producing continued hyperæmia of the blood-vessels, contained in the whole or a portion of one of the bones, may end in sclerosis. If the process occurs slowly, the parts may have time to adjust themselves to their altered circumstances; but if sclerosis occurs somewhat rapidly, especially when the growth of the bone has been nearly, if not quite, completed, the nutritive changes going on in the part are necessarily disturbed, and symptoms such as those I have described in the case of J. C. supervene, the course of the disease varying according to the rapidity of the abnormal action going on in the bone.

With reference to this subject Professor Billroth observes, that "the causes of diffuse sclerosis of bone as a primary disease are obscure; in some cases syphilis may act as a cause, but the osseous formations occurring in this disease rarely attain such firmness as in sclerosis proper. The malady will rarely be recognized with certainty during life, because to the touch these bones present nothing more than a certain increase in thickness and a slight inequality of surface." But sclerosis having once altered the whole or any part of a bone, the diseased structures can never resume their normal condition, and the part continues a source of trouble to the patient. My own opinion is that diffuse sclerosis of bone, such as I have described, in the majority of cases depends on inherited syphilis.

LECTURE IX.

MOLLITIES-OSSIUM (OSTEO-MALACIA) AND DEGENERATION OF BONE (BRITTLE BONES).

THE subject which will principally occupy our attention to-day, is the brittle condition of bones occasionally met with among people advanced in years, leading, for instance, to fracture of the neck of the femur. Cases of this description are frequently met with, and we can therefore consider the matter in connection with one of our patients at present under treatment. This, however, seems to be a favourable opportunity for making a few remarks upon mollities-ossium, an unfortunate name applied to a condition of the bones resulting, probably, from different causes; for soft bones are a condition always present in the early stages of rickets, depending on a deficiency in the earthy matter deposited in the hyaline matrix of the bone. In cases of mollities-ossium, however, the bone has, in the first instance, been fully formed; but it subsequently becomes pliable in consequence of the loss of its calcareous elements; under certain conditions these elements disappear, and the bone consequently becomes soft.

Mollities-ossium is consequently an affection of adult life, and may result from various causes interfering with a deposit of earthy matter in the hyaline matrix of the fully-formed bone. These causes may be permanent, as, for instance, when the medulla of the bone is replaced by a carcinomatous growth, or it may be transient, as in certain cases in which the bones have become soft in pregnant women (rickets of advanced life); but after the birth of the child the pliable bones again become hard.

I have a specimen here, the femur of a female formerly in this hospital, under the care of Mr. H. Thompson. "She gradually became diminutive. Her legs and thighs could be bent. She died in consequence of softening occurring in the bones of the thorax. Upon a post-mortem examination her femurs could actually be tied in a knot." In the catalogue of our museum, the preparation is described as being "a longitudinal section of the right femur, affected with mollities-ossium. The shaft of the bone seems to be the part chiefly affected; the cancellated tissue is pretty distinct in the head and great trochanters, and dimly visible in the condyles. In both parts, however, the cells of the bone are filled with fatty matter, which is the most abundant in the condyles. In the shaft of the bone scarcely any remains of cancellous tissue are visible. Large spaces occupy its places, of irregular form and various dimensions. The spaces near the upper part of the bone are about the size of a bean, and smooth, but the parietes of the lower ones are irregular masses of fatty matter projecting into the interior about the middle of the shaft. The bone is curiously bent upon itself and bulged or nodulated. Upon its exterior a thin external investment of lamelliform tissue may be traced almost throughout the bone. The whole length of the femur is eleven inches." The remarkable feature of this specimen is, that while the shape of the femur is retained, the bone has passed into a soft condition, so that it might readily be twisted into a knot. On examining sections of it we find throughout the greater part of the shaft that the medulla has disappeared, the whole of the osseous structure between the central canal and the periosteum has softened down, and its place is occupied by a fatty material resembling adipocere.

We can, however, form only an imperfect notion of the pathology of the disease until we examine sections through the extremities of the femur which are still comparatively healthy; here we find that the articular cartilages and the lamina of bone on which they rest are, as a rule, healthy in appearance, but the cancellated tissue a short distance from the cartilage is filled with round cells presenting all the characters of sarcoma; in other places the contents of the cancellated tissue are composed of a fine fibro-cellular material similar to that of cartilage when it has undegone fibroid degeneration. In some few sections we see the cells of the articular cartilage undergoing very peculiar changes, each of the original cells breaking up into a nest of cells which individually resemble the blood-globules of a fœtus. In fact, it seems as though the early stage of the disease existing in these specimens was nearly related to the condition noticed in cases of osteo-sarcoma: the cells of the medulla, from some obscure cause which we do not understand, have failed to perform their normal functions, their tendency under the circumstances being to revert to their cartilaginous prototype, as though there had been something defective in the living protoplasm of the part. Presuming that the round cells of the medulla are organisms the outcome of the cartilage-cells, in the case we are considering, the inherited tendencies of the cartilage-cells predominate, so that a considerable part of the medulla, in place of building up new bone to replace that which disappears in the ordinary course of disintegration, breaks up into a lowly-organized fibroid structure, and subsequently degenerates into a fatty substance such as that which we see filling the cancellated structure of this femur.

We can understand why in the later stages of the disease this bone has become soft, for its medulla, which reproduces the osseous tissue, has been replaced by structures such as I have above described, and so the femur has been converted into this pliable mass; in places its trabeculæ contain a system of perfectly-formed lacunæ surrounded by layers of soft fibroid structure, and the spaces encased by degenerated bone of this description are occupied with a crystallizable fatty substance. We can equally well, however, comprehend how it happens that, when softening of the bones has taken place, if the progress of the disease is stayed before destruction of the medulla has occurred, some of its cells might perform their normal functions and produce a comparatively healthy bone.

During the early stages of the malady above referred to, the patient usually complains of deep-seated pain, not unfrequently referable to the lower part of the spine, pelvis, or loins; the pain is increased by moving or by pressure applied over the part, and is hardly to be distinguished from that of muscular rheumatism, but it is usually accompanied with extreme lassitude, and sometimes with an uncertain feeble gait and continued fear of falling, without any loss of sensation in the lower extremities, or symptoms indicating softening or abnormal change in the spinal cord. Diminution of stature, deformity of the spine or pelvis, fracture or destruction of some of the long bones have been found to occur in various instances of this disease, but not always in the same order. The abnormal action involves one bone after another, until the spine and ribs become so much distorted that the action of the heart and lungs is interfered with, and the patient dies from pressure on parts essential to life, but not from disease of the viscera, which have, in many cases of osteo-malacia, been found healthy after death.

I cannot say that my observations have confirmed the views of Rindfleisch, that, in the majority of specimens of mollities-ossium, there is a striking dilatation and congestion of the medullary vessels, and I am still less disposed to agree with him in his theory, that in consequence of the stagnation of blood in the vessels an excess of carbonic acid is developed in the blood, which acid acts as a solvent to remove the earthy salts from the bone. It seems, however, unnecessary for me to occupy your time with further details regarding the changes in the bone observed under the microscope in cases of mollities-ossium, or to give you particulars of chemical analyses of bones affected with this form of disease. Not that I overlook the importance of accurate research of the kind, but so far as I know it has not added anything definite to our knowledge regarding the causes or pathology of osteo-malacia, and it is hardly likely to do so unless the specimens examined are taken, in the first place, from bones affected by the same form of disease; and, secondly, from corresponding portions of the diseased bones.

I have a specimen here in which softening of the bones had occurred during life. The patient died from widely disseminated carcinoma. These ribs can be bent like cartilage; they are not much altered in external appearance, but on comparing sections of these bones when dry with corresponding portions of a healthy rib we see how great a loss of osseous structure has occurred in the diseased specimen. In the bone, soon after death, we found that the whole of the open cancellated tissue was filled by a carcinomatous growth which had entirely replaced the medulla, and so brought about changes in the ribs similar to those I described to you as existing in this femur; in the one case, the soft condition of the bone being due to sarcomatous, fibroid, and fatty changes of the medulla, in the other to its destruction by a carcinomatous formation, illustrating the fact that softening of the bones during adult life may take place under various circumstances.

And this leads me to say a few words regarding instances of mollities-ossium, as it occurs among pregnant women. Dr. De Cosati, of Milan, has given a remarkable account of this affection; in fact, he treated no less than sixty-two patients in the course of eighteen years suffering from deformities of the pelvis produced by this disease. All these cases of osteo-malacia occurred among pregnant women or shortly after child-birth. It seems, however, that the conditions under which the patients lived had much to do with the development of the disease, for almost all the cases occurred among women residing in the valley of Olna, a district in which typhus fever is endemic. The patients came from wretched villages, where food was scarce, consisting for the most part of maize or rice, often eaten when in a musty condition. The women, as a rule, worked in close, badly-ventilated rooms. Added to these unhappy conditions, Dr. De Cosati supposes that the character of the water and vegetables with which the people eked out their scanty diet is largely concerned in the production of the disease.

It would be simply guess-work, in the present state of our knowledge, to speculate on the pathology of this peculiar form of osteo-malacia; but it is satisfactory to know that it is amenable, in not a few cases, to treatment. While endeavouring to alter the hygienic circumstances under which the affection occurred, we may with advantage order the hypophosphate of lime, ferric oxide, and cod-liver oil. Drugs of this description, together with good diet, have unquestionably proved serviceable in the treatment of osteo-malacia occurring during pregnancy.

Mr. Durham has collected the records of 145 cases of mollities-ossium, and his figures confirm the accuracy of Dr. De Cosati's statement, that the bones of the pelvis are most frequently affected, for in no less than 133 instances these bones became so much distorted as to interfere with the process of natural labour. Of the 145 cases of mollities-ossium referred to by Mr. Durham, 132 occurred among females, and of these 91 were pregnant when the disease commenced, the majority of the patients being from twenty-five to thirty-five years of age.

Dr. R. Atkins, in the number of the *British Medical Journal* for June 26th, 1880, has recorded a remarkable case of mollities-ossium, and, as he observes, it is at any rate a coincidence worth noticing in connection with the frequency of this disease of the bones among pregnant women, that his patient had mutilated himself so as for many years to have lost virile power.

"J. M., aged fifty-five, for over fifteen years an inmate of the Cork District Lunatic Asylum, and for the last seven years of that period bedridden from contractions and rigidity of the lower limbs. He had originally been a soldier; and while in India, some years before his admission to the asylum, he had, I presume in a paroxysm of mental alienation, removed the entire scrotum and testes. For several years subsequent to his admission he was lithe and active. He first came under Dr. Atkins' observation towards the end of the year 1873. He was then, and had been for some years, a bedridden and aged-looking cripple, with the peculiar effeminate physiognomy and scanty and almost colourless hair of those deprived of the organs of generation. As he lay in bed, the knees were fixed immovably in the flexed position, and the joint-ends of the bones appeared enlarged, but this was only comparatively so, from the degree of emaciation to which the thighs and legs had been reduced; the former were partially flexed on the pelvis, and quite immovable. He very frequently complained of intense pains, which he located in the knees principally, and would cry out lustily if any manipulation were attempted on them; lying always on his back, from which he could by no means move himself; answering invariably, when questioned as to his condition, with a smile, that he was quite well and hoped to be soon able to rise. He could use the arms and hands, and was scrupulously neat and clean in his habits and surroundings." His appetite was excellent; and, during the four years Mr. Atkins knew him, he never suffered from any acute illness or functional disturbance of any organ. His mental condition was characterized by mild though persistent dementia.

"On Friday, November 30th, 1877, another patient threw himself on J. M., with the effect of breaking both his thighs about their upper thirds and both lower limbs, the right being fractured in the middle, the left in the lower third. The position the limbs assumed was very strange-looking; the thighs were completely flexed on the body, and their anterior surfaces lay along the abdomen, the knees resting on the clavicles; the calf of each leg was in close apposition with the posterior surface of each thigh, and the heels touched the buttocks. He made no cry or complaint of pain; movement, however, of the broken limbs caused sharp pain. As the limbs could in nowise be straightened, and as the diseased condition of the bones was now made evident, from the slight force which had been sufficient to do such extensive damage, splints secured with bandages were applied, merely to give support to the powerless legs, which lay a dead weight on the abdomen. After about a week, however, the groin and lateral surface of the abdomen at the left side began to inflame. On the next day he died."

Mr. Atkins "made a post-mortem examination of the body twenty-four hours afterwards. The surfaces of the bones, beyond being slightly enlarged, presented no deviation from the normal condition. Any of the bones of the lower extremities mentioned could with facility be cut through with a scalpel, and the vertebral column cut during the removal of the spinal cord was in a similar condition. The head of the humerus was equally soft; but the calvarium was not notably affected. On section of the bones removed, the medullary portion was seen to be vastly enlarged, and the cortical layer proportionally diminished in thickness, being, over the heads of the humerus and femur, reduced to the thinness of paper; the cancellous tissue formed at the expense of the cortical was extremely delicate and friable, and its trabeculæ were everywhere loaded with a semifluid oily or fatty-looking material, which I have removed in great part by boiling. The cancellous tissue was not present in the shafts, but it made up almost entirely the heads of the bones, the morbid process being farthest advanced in the tibiæ and femora and least in the bones of the upper extremities. So softened was the osseous tissue, that a fine section was cut from the end of the tibia, and the patella was cut in halves with the scalpel." I need not follow Dr. Atkins into his description of the changes found in this patient's brain and spinal côrd, for, as he remarks, "Looking to the facts of the case, it may be asked if these different lesions, which microscopical examination has revealed, are not the result, together with the osteo-malacia, of the functional inertia to which the members were condemned from the long-continued disuse. That this functional inertia played some part in the causation of the degeneration of the osseous tissue is, I think, rendered highly probable when the correspondence between the distribution of the latter and the inutility of the limbs is taken into consideration. The bone-softening, as can be seen in the specimens, is much farther advanced in the lower limbs, which were perfectly useless, than in the upper, which still retained the power of movement; and, further, the fact that the spinal column, which rarely moved, partook in the disease adds weight to this; while the same consideration applies to the muscles and peripheral nerves, which were affected in a like degree to the bones. Against such a view, however, as Dr. Atkins remarks, it must be borne in mind that of all the many cases of permanent loss of motor power from cerebral hæmorrhage or other causes, spontaneous fractures of the limbs or breaks from slight injuries are in the highest degree infrequent; and here, of course, the same functional inertia is in existence; hence it is possible, and even probable, that in such cases as I have been considering, the primary nervous disease may have played a causal part in the alteration of the osseous structure, though as to whether this depended in any way on the histological lesions in the spinal cord, or had its origin in a defective nerve-nutrition generally, is by no means easy to say.

BRITTLE BONES.

You are probably aware that on examining the bodies of insane patients, their ribs have occasionally been found extensively fractured. It has been alleged, on the one hand, that these injuries were the result of ill-treatment on the part of the attendants or other persons entrusted with the care of the patient; on the other hand, it is asserted that fracture of the ribs was no evidence whatever of rough or improper treatment, because persons affected with mental disease are subject to a peculiar affection of the bones, especially of their ribs, rendering them so brittle that they break when an amount of force, which would be harmless in the instance of sane persons, is applied to them. This latter idea has been insisted on by some practitioners engaged in the treatment of lunatics, and their views have been supported by surgeons of eminence. On referring to some of the published reports bearing on this question, I find observations such as the following:—In one case after death "the sternum broke across during removal; the cancellated structure at the seat of the fracture was partly absorbed, leaving a cavity which contained unhealthy pus." Again—"While removing the sternum it broke across, between the second and third ribs. The compact structure forming its surface was very thin and brittle; the cancellated portion, soft, spongy, and easily crumbled between the fingers; while part of it was broken up and mixed with sanguineous pus;" the ribs are mentioned as being "soft, greatly deficient in inorganic matter, easily bent at a right angle," and so on.

You will agree with me, that observations of this description are not sufficient to convince you that the ribs of insane patients are at times diseased to such an extent as to render them extremely brittle, and, therefore, very easily fractured; in fact, to arrive at any definite conclusion on the subject is a matter of great labour, and can only be carried out satisfactorily by pathologists who have become thoroughly acquainted with the minute anatomy of the osseous system in health, as well as when affected by disease.

I commenced my researches into the state of the ribs of insane patients, fully expecting to meet with some interesting pathological changes in the bones, but I have been disappointed, for as I worked on at specimens of this kind, I gradually arrived at the conclusion which I now hold, that neither the ribs nor other bones of insane patients are subject to any peculiar abnormal changes which render them more brittle than the bones of other people of the same age, and this remark applies to the ribs of two insane patients found to be fractured after death. In one of these my results were confirmed by a chemical analysis of a portion of the broken bone close to the site of fracture.

I admit that insane persons, like other people, differ individually as to the time of life when they become old: a lunatic may be structurally as aged at fifty as another man is at sixty, or if the limbs are never used for weeks or months together under these circumstances his bones may become brittle when he is comparatively young in years; but this fact in no way favours the idea that insane persons are liable to an affection of the ribs, such as has been referred to above.

It seems to me more probable that when several of the ribs are found to be fractured during life or after death in the case of lunatics, in all probability the injury has been caused by the attendants kneeling on the patients' chests to keep them from moving, and that the ribs have resisted the extra pressure so long as the lungs were inflated with air, but directly they became empty the thorax has been crushed inwards, an accident just as likely to happen under the circumstances to a person in sound health as to one in an insane condition. As the matter now stands, if called on to give an opinion regarding a case of this kind, you can but affirm that you are unacquainted with any affection of the bones of the insane rendering them peculiarly liable to be fractured.

We know that the bones of some bedridden patients, whether suffering from mental or other diseases, such as locomotor ataxy or carcinoma, sometimes become so brittle as to break even by muscular effort, and that on examination the osseous structure is found to be atrophied in consequence of its having been imperfectly nourished, and hardly ever employed on the purposes for which it was chiefly constructed; it is surprising in cases of this description how well the brittle bones sometimes unite after having been fractured. It appears that the osseous-forming elements not only exist in some instances of the kind, but they respond at once if called upon to act, by the irritation produced in the part through an injury.

It is remarkable that, irrespective of mental diseases, brittle bones seem to be the rule rather than the exception with some people; for instance, we have a patient at the present time in H. Hoar ward, R. T., aged fifty-six; he was admitted into the hospital on May 15th, having fallen from a height of about twelve feet. His right humerus was fractured, also his right femur immediately above the condyles, and his right tibia and fibula in two places. Notwithstanding all these fractures, the patient's general health was unaffected, and the broken bones very quickly grew together again. R. T. had, on previous occasions, fractured his right femur and his right arm twice, also his right leg and both clavicles, so that almost all the long bones of his body have been broken once or oftener during his life, and yet the individual was a quiet, hard-working man, and his health, as a rule, has been remarkably good. Brittle bones of this kind sometimes seem to descend through several members of a family. Mr. Holmes, in his "System of Surgery," quotes from Gibson the case of a youth of nineteen who had twenty-four fractures; and from Esquirol another with as many as two hundred. Earle records a case of eight fractures in a child of ten years; and Fleming fifty-three between the age of one and a half years and twenty-four. In all of these cases, union took place rapidly. Stanley, however, quotes a case of five fractures, with subsequent yielding of callus, and the patient had to be discharged incurable. Savory also mentions a case in which yielding of the callus took place. In all of these cases only one member of the family was subject to the disease in question; but Arnott mentions a case of a child, fourteen years old, who had thirty-one fractures; and her sister, six years old, with nine. Jones, of Louisiana, records a case of a mulatto who had fifty fractures, with a cousin affected in the same way.

In connection with this subject, I may proceed to make some remarks on the senile changes occurring in the osseous system of old, though apparently healthy, people, by means of which their bones are apt to become fragile, a fall or slight injury fracturing them, as we not uncommonly witness in the case of the neck of the femur. In fact, as I before remarked, we are seldom without cases of the kind in the wards of the hospital. The following is an instance in point:—

Mrs. P., aged sixty-nine, has always been a healthy, hard-working woman; on the morning of June 27th she went to her employment as usual, but suffering from the excessive heat, she fainted and fell on the stone floor; on becoming conscious she was unable to rise, and when taken to the hospital, Mr. F. Poynder, our house-surgeon, discovered that the patient had lost all power over her left leg. She was suffering from great pain along the outer side of the thigh and in the region of the hip-joint. On getting her into bed and laying her flat on her back, he found the left foot was slightly everted and the injured limb almost half an inch shorter than the sound one. On making extension from the leg this shortening could not readily be overcome; although the attempt caused the patient much pain, there was no difficulty in flexing the thigh, or in rotating the femur either outwards or inwards; in doing so the trochanter moved with the head of the bone. Under these circumstances our house-surgeon very properly ordered a sandbag to be laid along the outside of the limb, and the patient was directed to remain in bed. The condition of her heart and kidneys was examined, and found to be healthy. She was a spare, by no means an old-looking person for her years. I saw Mrs. P. the following day, and having satisfied myself that the above report was accurate, came to the conclusion that this was a case of intra-capsular and impacted fracture of the neck of the femur, and my prognosis was, that although we could not expect to overcome the shortening and malposition of the limb, nevertheless we might fairly hope, in the course of some four months' time, to see the patient moving about again with the aid of a high-heeled shoe and a walking-stick.

We have now to consider the data upon which this opinion was founded. In the first place, as the patient lies in bed with her legs parallel to one another, it seems hardly possible to believe that the amount of shortening of the injured limb does not exceed half an inch. In measuring the leg under these circumstances, we should take the distances between the anterior superior spinous process of the ilium and the outer part of the greater trochanter of the femur, comparing this measurement with that of the sound side, and verifying the result by taking the distance between the spinous process of the ilium and the outer malleolus of the ankle-joint, presuming, of course, that the patient is resting flat on her back with her legs parallel to one another.

There can be no doubt that in the present instance, and in fact in by far the majority of these cases, the ends of the fractured bones are driven and impacted into one another at the time of the accident; and under these circumstances the shortening of the limb is equal to the distance to which the bones have been jammed into one another.

If the surgeon, however, under the mistaken notion of restoring the limb to its original length, makes forcible extension from the leg and foot, and drags the impacted ends of the bones asunder, then the lower fragment is, on the extending force being relaxed, apt to be drawn upwards and backwards by muscular contraction, and the shortening of the limb becomes perhaps two inches. Of course, in instances of intra-capsular fractures where there has been no impaction, the shortening of the limb may likewise be about two inches, but in these instances the head of the bone does not move with the trochanter on rotating the thigh, and on making, and keeping up, moderate extension (the patient being under the influence of ether), rotation of the limb generally affords a feeling of crepitation near the joint.

In this case the foot is slightly everted; for it naturally falls into this position after fracture of the neck of the femur, although it may be in a straight or even an *in*verted position if the impacted ends of the bone happen to fix it in either of these directions. If after an accident we find extensive ecchymosis of the skin over the upper part of the thigh, and there is loss of power over the limb and pain in the region of the hip-joint when the leg is moved, if there is a slight degree of shortening and eversion of the foot, but on extension and rotation of the limb no crepitation can be felt in or near the hip-joint, while the trochanter major moves with the head of the bone, and the latter rotates in the acetabulum when the patient is placed under the influence of ether, we may reasonably conclude that an impacted fracture of the neck of the femur exists.

I have here the head and neck of the thigh-bone taken from the body of a man who died about a year and a half after an intra-capsular fracture. In this case you observe that fibrous union has taken place between the head of the bone and the trochanter major; the neck of the femur has entirely disappeared, and in its place we find a firm fibrous structure; in fact, we might almost imagine that the neck of the bone had been macerated in acid until its earthy matter had been dissolved out, leaving its organic substance unaffected. If we carefully examine this fibrous material we shall discover that it differs but little from the growth which usually occurs between the ends of a recently-fractured bone, and which under favourable conditions becomes ossified, uniting the fragments together. Under ordinary circumstances, active hyperæmia occurs in the injured parts, and the round cells of the periosteum form a thin case of osseous tissue round the end of the fractured bone, which lasts at any rate until the work of consolidation between the extremities of the bone has been effected. But the ossification of the soft structures which grow from the medullary spaces of the broken bone is, in the human subject, a protracted process, and the tissues concerned are so delicate that unless they are protected from injury by means of artificial splints they seldom unite at all.

Under the most favourable conditions permanent union between the ends of the shaft of a fractured femur will not be perfectly complete within five or six months. The tissues from which the shaft of a long bone is repaired, after a fracture, are unquestionably the cells contained in the medulla, the soft structures from one end of the fractured bone uniting with those of the other end; the result is not simply a dense, hard, cicatricial tissue, but new bone, so that in the course of years it would be impossible in the section through the part to determine where the original line of fracture had occurred.

If we apply these facts to the case now before us, it enables us to understand the principles upon which our treatment and prognosis are founded. I hardly think the non-union between the ends of the bone in instances of intra-capsular fracture of the neck of the femur is most frequently due to the insufficient blood-supply of the head of the bone, otherwise we should more commonly meet with examples, after fractures of the kind, in which the head of the bone had become absorbed; but, as you will see in the specimen I now show you, the cancellated tissue of the head of the femur is supplied with blood through vessels passing along the round ligament, and through the fibrous structure, uniting it with the trochanter major. No doubt it may be a consoling idea to a surgeon in charge of a case of the kind, if he persuade himself that should union not take place between the ends of the fractured bone he is absolved from blame, because the anatomical arrangement of the parts rendered it almost impossible that union should occur. I admit that there is some truth, however, in this notion, and fractures of the neck of the femur happen most commonly among persons whose bones are brittle; that is, they have undergone senile degeneration. The bone-cells, probably from inadequate vital power, secrete an imperfect hyaline material, and the space in which the bone-earth has to be deposited being diminished, the strength of the bone is lessened; in other words, it becomes brittle in patients affected in this way. The reparative process is uncertain; they are, as I have before remarked, old in structure though perhaps not in years.

But fractures of the neck of the femur are usually impacted, and this means that the delicate cancellated tissues in the ends of the broken bone are jammed into one another, and unless you have examined specimens of the kind carefully you can hardly understand the amount of damage which is inflicted on the medullary and trabecular structures by this accident, so that in addition to the lengthened period necessary for the reparation of an ordinary fracture, time must be allowed for the reconstruction of the smashed cancellated tissues.

Then, again, there is here a peculiar modification of the periosteum, its deeper layers alone intervening between the bone and synovial membrane, so that the blood-supply necessary to form active medulla is limited within the capsule to vessels reaching the cancellated tissue through the round ligament and from the bone beyond its neck. But surely this makes it all the more necessary for the surgeon to afford artificial aid, endeavouring to keep the ends of the fractured bone in apposition. If the anatomical formation of the parts were the sole cause for non-union, how is it that in intra-capsular fractures of the head of the humerus, which are also as a rule impacted, not only does firm union occur between the head and shaft of the bone, but it is not at all uncommon, in cases of the kind, to find a large quantity of new bone thrown out around the injured part?

No class of cases requires greater care and patience to be exercised both by the surgeon and his patient than those of fracture of the neck of the femur; and if you believe that Sir A. Cooper was correct in his advice not to keep a patient confined to his bed after an accident of this description beyond a week or ten days. and that you may allow him to sit up and move about on crutches as soon as he feels that he can do so without pain, then, of course, there is an end of the matter, for it stands to reason that whether the fracture be an impacted one or not, the weight of the leg must inevitably move the lower fragment and effectually prevent the delicate medullary tissue from forming new bone.

But it is evident that the ends of the bone in a fractured neck of the femur will unite under certain circumstances, and it is impossible to tell how far the influence of Sir A. Cooper's teaching has been the indirect cause of the number of instances of ununited fractures of this kind which we meet with in practice. No doubt, as I before remarked, the reparative processes under these circumstances are slow, because the vital powers of the patient are at a low point; but that is all the more reason why we should persistently exercise our surgical skill, rather than excuse ourselves for standing with folded hands and doing nothing.

In the specimen before us, at first sight we might conclude that the only structure connecting the head to the shaft of the bone is a dense fibrous tissue; but on closer examination you perceive that there are several spurs of bone passing from the cancellated tissues of the head of the bone towards the trochanter major. You will find processes of a similar nature in most of the preparations existing in our museums, and there is no reason at all why the structure surrounding this process of bone should not also have produced osseous tissue: in fact, it is not always the bone-forming power of the part that is at fault, but it is often the circumstances under which these delicate structures have been left by nature and the surgeon, which have effectually prevented the growth of the necessary bone to repair the fracture. I believe, if you can keep the parts at rest, in many cases of intracapsular fracture union of the ends of the bone will occur.

I need hardly remind you that in instances of fracture of the neck of the femur it is necessary, before venturing on a prognosis, carefully to examine the condition of the patient's heart and kidneys, for in chronic affections of these organs œdema and consolidation of the lungs are apt to occur, and this danger is increased if a person suffering from disease of the kind is laid on his back in bed for any considerable length of time.

I admit also that non-union is more common after these fractures than in similar injuries to other bones, and I have given reasons why such should be the case; but then I hold most firmly that it is your duty to do all in your power to procure union between the ends of the fractured bone. We may fail, and so great may have been the injury done to the medullary tissue that, although the impacted bones hold together mechanically for a time, ultimately absorption of the injured structure takes place, and so what appeared at first to be a fortunate case turns out a disastrous one. But if the surgeon has confidence in himself he will impart the same feeling to his patient; and the facts of the case being explained, no reasonable creature would fail to choose the wiser part and give himself the opportunity of being cured. With this object in view our patient in Queen Anne's ward remained in bed for two months from the time of the accident; she was then permitted to lie outside the bed, but on no account to put her foot to the ground for another month; and the result has been, as Mr. Poynder reports, that she left the hospital with only slight shortening of the limb and eversion of the foot; but was able to move about with perfect freedom aided by a walking-stick. This is the second case of the kind I have seen within the past few months.

You may exclaim against a system of treatment involving three or four months' confinement, but surely that is better than the entire loss of power in the limb for life, if it affords a reasonable hope of doing good. At any rate, your line of action is clear enough—to insist upon that which is best calculated to lead to the recovery of your patient, and if your advice is refused, to clear yourself from further responsibility. Provided your patient is free from organic disease, and has not been roughly handled in the first place, and thus had the impacted ends of the broken bone drawn asunder, you may reasonably commence the treatment of the case under the impression that union of the fractured bone is likely to occur, and that your patient runs no very great risk of bed-sores or hypostatic consolidation of the lung. Much may be done towards warding off this latter complication by having the patient placed on a bed constructed so that his body may be raised into the semi-erect position without throwing much weight or movement on the injured hip.

LECTURE X.

CONTUSION, FRACTURE, NECROSIS, AND ULCERATION OF BONE.

OUR hospital note-books contain the records of numerous cases of contusion of bone, for hardly a week passes without accidents of this kind being received into our wards. For example—

William H., a labourer, while at work, some three weeks ago, was struck by an iron bar across the lower part of his left leg. The soft tissues were bruised. He continued at his work, however, for twelve days after the accident. He was then compelled to rest in consequence of the great pain he suffered in the injured part, and, under these circumstances, he was admitted into the hospital. We found the lower third of his leg slightly swollen. There was no redness of the skin, but he complained of deep-seated pain in the bone, especially when pressure was made over the anterior surface of the tibia. His temperature rose to upwards of 101° at night. A splint was applied to the leg extending beyond his foot, so as to prevent his moving or standing on the injured leg. The limb having been kept at rest for a fortnight, the pain subsided, and the patient left the hospital cured.

Simple as the details of this case are, they illustrate the fact, that at the time of injury the medullary tissues of the bone were bruised, and in consequence of this contusion of the parts, its nutrition had become impaired, not only by the bruising of the tissue, but also from effused blood pressing on the vascular sinuses of the medulla and impeding the circulation in the part. The contents of the cancellated tissue of the bone are, under these circumstances, in somewhat the same condition as the brain after concussion, and the period of reaction is one of more or less excitement depending on the amount of injury and the treatment the patient has received. The medulla, like the bruised brain, must have rest in order that it may regain its proper functions, otherwise the reparative process may not only be delayed, but in overcoming the opposition to healthy nutrition in the part, superabundant elements may form, and so suppuration with its consequences are established leading probably to necrosis of a portion of the bone, or it may be to epiphysitis, or to acute osteo-myelitis, such as I have so frequently referred to in previous lectures. On the other hand, if the mechanical injury done to the medulla is not excessive, and the patient is in fair health, with rest, the effused blood in the contused tissues is absorbed, and the parts return to their normal condition.

It is not difficult to satisfy oneself that extravasation of blood does occur into the medulla after an injury to the bone such as I have described, for accidents of this kind are not uncommonly received by persons who have likewise been severely injured in other parts of the body, resulting in the death of the patient. Under these conditions, I have made sections of the bones in the contused limbs, and found the cancellated tissue full of extravasated blood; the osseous trabeculæ being incapable of distension, the blood effused into its spaces presses with injurious consequences upon the delicate and torn structures of the medulla. Some of these specimens clearly demonstrate that extravasation of blood from a contusion may take place into the cancellated tissue without there having been any perceptible mischief done to the periosteum.

It is certain that in severe concussions of the spine hæmorrhage may occur into the bodies of the vertebræ, leading to disease of the bones and irreparable injury to the spinal cord; although the elastic inter-vertebral substances are a protection against such an accident, it is well to bear the fact in mind, because hæmorrhage taking place into the osseous tissue, producing perhaps no marked symptoms at the time, may subsequently set up diseased action in the spinal column. A severe sprain may, in this way, induce serious disease, as in a case mentioned by Mr. Stanley: "A middle-aged man, whilst holding a ladder which he had raised from the ground, was turned sharply round by a gust of wind. From that instant he felt pain in his back, which continued; and in the course of the following six months angular projection of the spinous processes of the middle dorsal vertebræ ensued, with complete loss of motion and sensation in the lower limbs. He gradually sank. On examining the spine, I found the bodies of three of the dorsal vertebræ extensively ulcerated, and a detached piece of the middle of these vertebræ displaced backwards into the spinal canal, and compressing the cord."

Dr. J. Russell, of Birmingham, reported a similar case in the "British Medical Journal" (March 22nd, 1880). His patient was a medical practitioner, aged 56; he was of vigorous intellect and excellent constitution. In May, 1870, he was thrown from his horse, but was unaware of any injury till he arrived at home, when his son discovered a fractured clavicle. He suffered absolutely no inconvenience, and continued actively engaged in practice. On January 1st, 1871, the weather being then very cold, he was called out of bed at night to see a patient; on his return he was greatly depressed and shivering. In the course of the next fortnight he suffered severe pain and irritation of the neck of the bladder, never previously having suffered from urinary symptoms. On January 17th, 1871, the patient was exceedingly depressed; but there was neither abscess nor any cause for the urinary symptoms, and healthy urine was drawn off. A week later a large abscess formed in the ischio-rectal fossa, and this was followed by secondary abscesses in the left thigh and leg and right arm, with a puffy swelling on the scalp, which was followed in the course of years by exfoliation. In the spring he was able to walk in the garden; but, on April 15th, the first signs of loss of power in the legs manifested themselves, and the paraplegia rapidly increased. From this time he was never able to use his legs again.

During the first twelve or eighteen months after the commencement of the paralysis there was much rigidity of the paralysed muscles, and the patient was much annoyed with frequent involuntary movements of the legs, especially at night; but the muscles remained fairly nourished. Cutaneous sensibility was never greatly diminished; but he suffered much from persistent pain aggravated in paroxysms around the base of the chest. It should be mentioned that his perceptive centres were distinctly hyperæsthetic. The vertebral column was repeatedly examined, with an absolutely negative result till more than two years after the accident, when the sixth dorsal vertebra was found abnormally prominent.

On two occasions the patient suffered from alarming attacks of cardiac distress, for which no cause was discovered. Though at times depressed, the intellectual faculties remained clear. Death took place in April, 1878, after an illness of eight years. The immediate cause of death was uræmia.

Necropsy.—The sixth and seventh dorsal vertebræ were completely incorporated, so much so that the only evidence of a previous separate existence of the two bodies was in the indications rather than the remains of the fibrous layer of bone forming the upper surface of the healthy body. The united bodies were wedge-shaped and bent at an angle of 130°; their spongy tissue had fully recovered itself and presented its usual appearance. No trace of caries existed. A lamina of new bone ran along the front of the bodies. The vertebral laminæ were united together by bony matter. The vertebræ below were healthy. The upper portion of the spinal cord was greatly compressed by the close adhesion of the membranes, and was so much reduced in size that the section measured only three-eighths of an inch transversely, and a quarter of an inch from front to back. For the upper three inches and a half the membranes were remarkably thickened and very dense, and adhered to the cord itself so closely that very careful dissection was required to effect its separation. In the upper half of this three inches and a half the grey matter was clearly defined, but was attenuated; below this, the cord was completely softened. Further down, the cord recovered its natural consistence, and the grey matter reappeared, but was unusually pale. In passing down, the anterior horns became indistinct, and a broad tract of secondary sclerosis ran down by the side of the posterior horns, extending into the lateral columns. A portion of bladder examined presented a livid thickened mucous membrane, and the kidneys had the ordinary characteristics of the so-called surgical kidney.

Dr. Russell remarks that the patient had a fall from his horse nearly twelve months before the earliest grow together, in much the same manner as the edges of a wound do which is being repaired by the process of granulation. But there is this difference in the nature of the reparative process between a breach of continuity of bone and the other soft structures of the body, the elements constituting a considerable portion of the periosteum and of the medulla are destined to form osseous tissue, and consequently, after union has taken place between the elements growing from either end of the fractured bone, these soft tissues become ossified.

For instance, supposing in the case of a man's tibia which has been fractured at its lower third, if the patient, immediately after the accident, is brought into the hospital (the skin of the limb having been uninjured), the ends of the broken bone being carefully adjusted, and the limb secured by splints or a plaster of Paris bandage. On removing the bandages at the end of six weeks we find round the site of fracture that a certain amount of new bone has been produced, and that the ends of the broken tibia have united: in another three weeks or a month the patient is able to limp about the wards, and in a short time resumes his work.

Under conditions such as I have described, in the course of a week or ten days after the accident, the blood effused into the periosteum and between the ends of the broken bone is absorbed, and the circulation through the injured tissues restored. We have, therefore, a free supply of blood, and an abundance of bone-forming cells in the medulla and periosteum at the site of fracture, ready to commence the process of repair. The injury done to the part at the time of fracture throws the component elements of the periosteum and the medulla into increased activity. We might almost say, in the terms of modern science, that the force necessary to effect the fracture having been communicated to the living cells, has converted their potential into active energy, so that on the re-establishment of the circulation through the injured structure the cells of the periosteum increase rapidly, and forming a hyaline material round themselves, secrete bone-earth into their soft covering, and produce a cartilaginous ring round the fractured bone, forming a provisional callus, as it is called. I have already given my reasons for thinking that neither the blood nor lymph effused about the ends of a fractured bone has much to do with its reparation (p. 15). The provisional callus is firmly attached, in fact is a part of the bone, but it is apt to hinder the passage of vessels into the shaft of the bone from the surrounding soft structures, and so impede the process of repair to be effected by the round cells of the medulla; but as the laws influencing the symmetrical proportions of the body resume their action, the perverted growth of the periosteum at the point of injury is limited, and ultimately ceases, and consequently the callus disappears. In the meantime the medulla has produced an abundance of bone-forming elements; these growing from either end of the broken tibia unite without forming cartilage, and the continuity of the fractured bone is re-established; so that in the course of years it may be impossible to discover the site of the fracture.

As I have repeatedly demonstrated to you, the cancellated structure of the ends of the long bones is largely supplied with blood from vessels passing through the periosteum, anastomosing with branches of the nutrient artery; consequently, if a bone is so fractured that the nutrient vessel is torn across, the lower fragment receives a sufficient supply of blood from the periosteal vessels to keep it alive, and capable of producing new bone. But suppose the fracture happens to be across the lower third of the tibia, midway between the cancellated tissue of the inferior extremity of the bone and the entrance of the nutrient artery into the bone, then the lower fragment at the site of fracture may only receive a limited supply of blood, supposing the branches of the nutrient artery have been torn across, and its medulla, therefore, be unable to produce any new bone; under these circumstances the fractured bone will remain disunited—in other words, an ununited fracture is the result; and it may be that the lower portion of the tibia becomes somewhat atrophied from an insufficient blood-supply. Complications of this description are more likely to occur in old and weakly subjects than among patients in good health and vigour.

The most common cause, however, of the non-union of fractured bones is, that the fragments are not brought and retained in exact apposition with one another. I have already referred to this subject when speaking of fractures of the neck of the femur (p. 231). If the union of a fractured bone is hindered for any considerable time, the ends of the broken bone are very apt to become sclerosed, and the dense new bone thus formed at either extremity of the fracture must be excised, if we wish to get union between the ends of the bone, so that the medulla from either fragment may sprout out, unite, and the two growing together, become ossified, and thus re-establish the continuity of the shaft of the bone. But sclerosis of the ends of a fractured bone is a work of time, and hardly occurs within a period of six months, so that if after putting up a fracture we discover in some ten or twelve weeks that union has not taken place, we should give the patient chloroform, and rub the ends of the broken bone with considerable force against one another, so as to excite fresh action in the part, and break down any fibrous tissue which has formed between the ends of the fractured bone, and then readjust the limb, taking the greatest care to get the fragments into accurate apposition, and to keep them absolutely at rest for two months or so. It is only after all other means for promoting the union between the ends of the broken bone have failed that we are justified in performing so serious an operation as cutting down upon the fracture, and sawing off the ends of the bone. If we are obliged to resort to such a proceeding, it will generally tend much to the success of the treatment if the extremities of the fractured bone are cut obliquely, and then having been laid accurately in apposition, retained without the possibility of any motion taking place between them until they have grown together.

We can hardly have a better illustration of these principles than that afforded us of transverse fractures of the patella. In cases of this kind there is considerable difficulty in obtaining osseous union between the ends of the broken bone, the lower fragment being firmly fixed to the tibia by the ligamentum patellæ, while the upper fragment is drawn away from it by the action of the rectus femoris muscle. The synovial membrane, also, upon which the broken patellæ rests, often becomes distended with fluid, not only tending to keep the fragments of the broken bone apart, but it is apt to bulge forward between them. In order to overcome these difficulties various expedients have been devised, such as that of cutting down upon the recently-fractured bone, and passing wires through it so as to tie the fragments of the bone together. It seems to me, however, that in recent cases of fractured patella the ends of the bone may be brought together by a more simple operative proceeding, as for instance, in the following case :—

A Hansom cabman was admitted to the Westminster Hospital, July 26th, with a transverse fracture of the left patella, the fragments being one inch and a half apart even before effusion into the joint had taken place. On August 10th the joint was fully distended; it was found to be impossible to get the fragments in apposition, and the serous fluid from the joint was drawn off by means of an aspirator. I then severed the insertion of the quadriceps muscle into the patella subcutaneously, when the fragments of bone were easily brought into close contact, and fixed with strapping, the limb being placed on a straight back splint. Later on, a plaster of Paris splint was adapted. The patient was last seen in August of this year—rather more than twelve months after the accident; he had long since resumed his occupation, could hop on the left foot, and the union, which to all who saw the case appeared to be osseous, was so close that it was very difficult to feel the line of fracture.

Another case was that of a porter at the House of Commons, admitted May 9th, with a transverse fracture of his left patella. Next day the distended joint was emptied by the aspirator, and the serous fluid it contained was drawn off. I then subcutaneously divided the muscle as in the above case, and finding that was insufficient, also divided the ligamentum patellæ, when the fragments of bone were readily adjusted. The further treatment was the same as in the above case. There is very close union between the fragments of the patella, but it is fibrous, not osseous. The joint is stiff from long use of straight splints; the patella is not adherent to the femur, but moves over it freely. The patient finds his limb so useful that he is loth to enter the hospital again to have passive motion applied, and the bands of adhesion which have formed round the joint broken through.

These, and similar cases treated in this way, demonstrate the fact that in instances of fractured patellæ, as with other bones, we must, to procure osseous union, retain the fragments of the bone in accurate apposition, so that the medulla they contain can grow together and ossify.

If the blood, lymph, or surrounding soft structures were capable of forming bone, there is no reason why ununited fractures of the patella should be of such common occurrence, for the fact of the ends of the broken bone being separated from one another for about an inch and a half, should not prevent osseous union, supposing the effused blood or soft tissues are capable of forming bone, and so of filling up the gap left between the broken pieces of the patella.

Fractures of bone become much more complicated when the ends of the broken bone communicate with the external air through an opening in the skin—not that the actual union between the ends of the bone differs under these conditions from the process I have described in cases of simple fracture, but the admission of the atmosphere into a wound is liable to excite suppuration and decomposition of the inflammatory products, and these decomposing substances, if absorbed into the circulation, poison the blood. Without discussing the nature of the putrefactive process, it is impossible to deny that the admission of the air of our wards into a wound will induce decomposition in the serum and other discharges, and it is equally certain that these matters, if absorbed into the circulation, will produce more or less septic poisoning (p. 24). Consequently, in treating cases of compound fracture, we must endeavour either to make the best possible provision for the free drainage, or escape, of putrefying fluids from wound, or else by means of Mr. Lister's system of antiseptic dressing, we should prevent decomposition from occurring in the wound; in fact, turn the blood, serum, and what would otherwise be waste substances and a danger to the patient, into materials by means of which the reparative process may be quickly effected in the injured tissues.

Broadly, therefore, our choice seems to lie between the open wound system and the antiseptic treatment, the question being—Is it better to leave wounds such as compound fractures exposed to the air with no covering except the cradle to protect them from the bed-clothes, or shall we employ Lister's method of treatment? We need not here discuss the modifications of these systems of dressing wounds, because if you do not prevent putrefaction from taking place in the discharges from a wound, it is probably better to leave the part exposed, so that we can see and smell the discharges, if there are any, and keep the wound as clean as possible, pus being allowed to flow freely away into receptacles provided for it. I believe, however, that with ordinary care we can prevent putrefaction and suppuration from taking place in cases of compound fractures by Mr. Lister's system of dressing, and that this plan of treatment is, therefore, preferable to that of leaving wounds of the kind exposed to the air, because, however free the drainage may be from the wound, there is always considerable danger of absorption of putrid matter under the open system of treating wounds. Practice confirms this idea, for in many hospitals, especially in hot climates, pyæmia is by no means of uncommon occurrence after compound fracture treated by the open system; and supposing there were no danger to life under these circumstances from septic poisoning, still, so far as our hospital patients are concerned, the open plan is frequently most objectionable on account of the offensive and unwholesome smell it causes in the wards. Beyond this, suppuration produces a considerable and unnecessary drain and waste of power to the system; and, further, matter forming and burrowing round the ends of an injured bone may strip the periosteum from the bone, and, by destroying the medulla, lead to osteo-myelitis or to necrosis and its consequences.

Among my hospital cases in Calcutta in former years it was rather the exception than the rule for patients suffering from compound fractures of the lower limb to recover, their fate in the majority of cases being to die of pyæmia; the mortality was hardly less after primary amputation in accidents of the kind; but in later years, by the use of antiseptic dressings, compound were almost as successfully treated as the simple fractures.

Since leaving India I have seen the antiseptic treatment of compound fracture successfully carried out in several of the large continental cities, and in some of them, as, for instance, in St. Petersburg and Moscow, under most unfavourable hygienic circumstances. Nevertheless, my own observations and the testimony of almost all the surgeons I have met, who have honestly practised this treatment, has been uniformly favourable to the antiseptic treatment of compound fractures, so that I have no hesitation in recommending you to adopt it, in preference to leaving such wounds exposed to the air or covering them with any other dressings.

The following is a case in point, reported for me by Mr. G. Butler:—On February 4th, A. D., aged thirty-four, met with an accident through the fall of an hydraulic lift by which he sustained a severe compound comminuted fracture of the right fore-arm, besides several other injuries. On arriving at the hospital the wounded arm was covered up in folds of linen, soaked in carbolic oil. I was sent for by our house-surgeon, Mr. J. E. Neale, who thought that it was necessary to amputate the limb. I found both bones of the patient's fore-arm crushed, and several small pieces of the contused bones were taken away from a large wound in front of the arm. There was a similar wound at the back of the limb, the arm at the site of injury having been literally smashed. I could detect no pulse at the wrist, and the hand was cold, and without sensation. Although little hope was entertained of saving the limb, we determined to give the patient every chance, and syringed out the wounds carefully with a solution of carbolic acid (one part of acid to eighty of water) under the spray; as the external structures were so much lacerated on both sides of the limb, it was unnecessary to employ drainage tubes. After thoroughly cleaning the bruised tissues we covered them with protective material and then packed the limb in shreds of antiseptic gauze over which antiseptic dressings were applied, the whole being retained in place by means of carbolized bandages. The hand was wrapped in cotton-wool and the limb laid on a pillow.

Two days after the first dressing a second was applied in the same way; the hand was still cold, and no pulse could be felt in the radial artery; the patient's temperature had not risen above 100°.

The dressings were now undisturbed for a week, by the end of which time warmth, and some amount of sensation, had returned to the hand; the wound looked remarkably healthy, there was no discharge whatever from it.

I will not trouble you with the further details of the case. Under Mr. Neale's careful dressing the patient's temperature never rose above 100°, and the broken bones united as though the accident had been a simple fracture, so that on March 6th, or just one month after the injury, our patient was discharged from the hospital, as Mr. Butler remarks in his casebook, "with the arm in good position, both wounds having entirely healed."

This result might have been effected if other dressings had been employed, but I state my belief that no more speedy or satisfactory conclusion could have occurred in a case of this description; and when one sees a number of instances of the same kind following one another in unremitting succession, we may, I think, claim the result as largely due to this system of dressing.

The occurrence of *Fatty Emboli** in connection with fractured bones has hardly attracted the attention in this country which the subject deserves. In the "British Medical Journal" for November 8th, 1879, you will find an article on "Fatty Embolon," from which I have taken the following remarks:—

"Some years ago Zenker found the pulmonary capillaries, of a man who had been crushed to death, full of fat. Wagner and Busch, of Königsberg, published, almost simultaneously, their researches with regard to the origin of fatty emboli. These authors showed, by experiments and by clinical cases, that this form of embolon generally takes its origin from the fat-cells forming the medulla of the bones, and that it is found most frequently in fractures and other injuries where the medullary canal is implicated. That the condition was not due to the physiological absorption of fat, was proved by the fatty emboli being found to be present in direct proportion to the severity of the injury. It would seem that the fat-globules of the medulla, being set free by the injury, are taken up by the open vessels and carried by the blood-current until they are stranded in vessels too small to admit of their passage, generally the lung-capillaries; primarily, the cells are not absorbed in a state of emulsion. In order to ascertain the vessels by which the fat gained access to the circulatory system, Busch abstracted the medulla from the long bones of dogs, and filled the canal with olive oil coloured with vermilion. By these means it was discovered that only the large blood-vessels and lymphatics absorbed the fatty globules. Since the earliest records of cases, where the presence of this form of embolon has been demonstrated, more than a hundred and forty instances have been published, most of them emanating from German authorities.

---

* The Latin word embolus, plural emboli, is, I think, more commonly used than the Greek ἔμβολον, plural ἔμβολα.

"In a recent number of 'Le Progrès Médical,' in order, as it is stated, to draw further attention to this important subject, M. Déjerine has recorded two cases which have come under his own notice. A patient, aged sixteen, was admitted into the Hôtel Dieu, his right leg having been crushed by a tram-car. Death ensued in about an hour after receipt of the injury, the patient being sensible to the last; a certain amount of blood was lost at the time of the accident, but we are not told that the quantity was excessive. At the necropsy, both bones of the legs were found to be fractured about their middle third, a crack extending upwards into the knee-joint. The blood in the right ventricle of the heart was discovered to contain fat-globules. The vessels of the lung, arteries, veins, and capillaries, were, by the aid of the microscope, seen to be filled with small adipose masses, which disappeared under the action of ether, and with osmic acid took on a black coloration. The same results were found on examining every portion of the two lungs. The second instance was that of a man who succumbed thirty-six hours after he had sustained a fracture. In this case, also, fat was present in the pulmonary vessels, although it would seem not to such a marked extent, the parietal bone only being the injured portion. The other organs and tissues were not examined in either body for the purpose of seeing if the emboli were likewise present in them. From these two cases, and from others, it would seem that fatty emboli, occurring as a complication of fractures, often speedily lead to a fatal termination; it being supposed that this is brought about by an important portion of the capillary system being practically obliterated and rendered useless by becoming clogged with an accumulation of fat-cells. Bergmann's experiments support this view. Small quantities of pigs' fat were introduced into the saphenous veins of cats by this investigator; the animals usually died in a quarter of an hour. In these the substance of the lungs was found congested, and the vessels of the organs filled with fat. In cases where the cats survived for periods varying from six to twenty-four hours, the vessels of the liver, the glomeruli and tubules of the kidney were invaded by fat-globules. In a second series of experiments, the animals living for a week or more, the vessels of the various organs were free, but the cells were discovered in the cellular tissue surrounding them. A point worthy of consideration with regard to the kind or embolon in question, is the effect of injecting recent compound fractures with strong solutions of carbolic acid, a plan adopted at the present time by surgeons who carry out the antiseptic method in the treatment of these injuries. Does the process favour or retard the formation of fatty emboli? As far as we can ascertain, no investigations have as yet been made with regard to this; even the Halle clinic has no information to offer."

M. Déjerine states that, although the embolus occurs most frequently in bony injuries, yet it may also be found, if sought for, in other cases where life is suddenly terminated by violence. This is confirmed by an observation of Dr. Hamilton, who showed lately at the Medico-Chirurgical Society of Edinburgh, microscopical specimens of the pulmonary vessels plugged with fat, taken from a case in which the patient had died after rupture of a fatty liver. The report of Busch, composed of about 45 cases, is made up of 23 fractures, 3 cases of osteomyelitis, 2 of bony tumour of the lower extremity, 1 each of caries and tumor albus, 4 of abscesses in regions rich with fat, the remainder of patients with metritis and fatty degeneration of the arteries from Bright's disease. Considering the facts that have been here enumerated, it is more than probable that fatty emboli are of common occurrence, as it may be reasonably supposed that they are present, more or less, in nearly every simple fracture, and, therefore, in a minor degree, do not necessarily lead to a fatal termination. In severer injuries, the formation of the same may, in conjunction with the so-called "shock," lead to a speedy death; but it is difficult to understand how pulmonary capillary emboli, of whatever nature, can *per se*, in a short space of time, cause a cessation of life.

Scriba has investigated the changes produced in the lungs by the fatty emboli. Oil was injected into the veins, into the medulla of the bones, and into the abdominal cavity of rabbits, and in all instances the pulmonary vessels were found to contain numerous fatty emboli. In performing these experiments, it was observed that rapid injection of the oil is more fatal than a slow injection. When injected into a vein close to the heart, an amount of oil which, introduced under high pressure, would cause immediate death, if injected slowly, produces scarcely recognizable effects. The fatty emboli are bland, and are not, as Wagner supposed, causes of pyæmia or secondary abscesses. The fat does not pass through the walls of the capillaries, but the plug becomes loosened and carried on in the general circulation, as formerly described.

With regard to the quantity of fat required to kill an animal, he comes to the conclusion that varying amounts will be necessary, according to the *vis à tergo* and the distance of the point of entrance of the fat into the circulation from the heart. If the *vis à tergo* be but little, or if the distance be great, so that the increased blood-pressure produced by the entrance of the fat is equalized before it reaches the heart, a healthy animal requires a very large quantity of fat to kill it. The shorter the road, and the greater the *vis à tergo*, the less is the quantity of fat required; but in no case does Scriba think that less than three times the amount of fat present in the femur of the animal would be able to cause death. On examining the animals which died of fatty embolism, it was found that the vessels of the brain were very markedly blocked with fat; while, when these emboli were absent, or only present in small numbers, death did not occur, even although the lungs were full of them. In no case did he find death occur from acute œdema of the lungs. He therefore concludes that, in pure fatty embolism, death occurs only in consequence of extensive embolism of the vessels of the brain and spinal cord, and is due to the arterial anæmia and consequent disturbances of nutrition produced by the emboli.

He gives the following as the characteristic symptoms of fatty embolism: presence of fat in the urine at intervals; transient attacks of dyspnœa; lowering of temperature; temporary slight hæmoptysis, without fever, and generally without dulness or *râles;* irregular action of the heart; collapse, with marked pallor of the skin and mucous membranes; at first, shallow respiration, at times interrupted by deep sighing inspiration, later Cheyne-Stokes' respiration; spasms of various kinds or paralyses, generally bilateral; diminution of reflex irritability.

NECROSIS OF BONE.

When speaking of contusions of bone I remarked, that after an accident of this kind the blood effused into the medulla may become absorbed, and the parts return to their normal condition. Supposing, however, that the effused blood remains unabsorbed, or is poured out in such large quantities that it presses upon the unyielding vascular sinuses of the bone, and thus impedes the circulation through the injured part, it may be to such an extent that the injured portion of bone dies, or, in other words, becomes necrosed.

A frequent cause of necrosis is the formation of a collection of matter immediately around the shaft of one of the long bones. As the pus increases in quantity it separates the soft tissues, and with them the blood-vessels, from the adjacent bone, and consequently its superficial layers die. In acute osteomyelitis we found the whole of the shaft of the tibia necrosed. A portion of another tibia was necrosed in one of the instances of syphilitic disease I referred to. In a case of acute periostitis almost the whole of the superficial layers of the fibula were necrosed, so that you will understand necrosis of bone simply means the death of a portion of the osseous tissue without reference to the causes which have brought about this result. Necrosis, however, as a rule, depends upon a defective supply of healthy blood to the affected osseous tissues, hence the greater liability to necrosis of the shaft of the long bones, supplied to a considerable extent by blood from the nutrient artery, than of their caneellated extremities which are permeated by numerous vessels from the surrounding soft structures.

Limited necrosis, the result of contusions, wounds, or inflammation of bone, is of frequent occurrence; we may explain its circumstances by reference to a case lately under my care in the H. Hoare ward.

In this instance the patient, from the nature of his occupation, was out of health; he was a compositor, and was employed for many hours of each day in a dark close room. He received a severe blow over the right fore-arm which entirely disabled him for upwards of a month; he then went to work again, the injured arm being still painful and swollen. Subsequently sinuses formed, and on his coming into the hospital fourteen months after the accident we found three openings in the arm leading down to dead bone which had separated from the surrounding living osseous tissue, forming a sequestrum. The necrosed portion of bone was evidently surrounded by a case of newly-formed osseous tissue, so that I could not move it with a probe, and I consequently cut through the soft parts and peeled back the periosteum, and broke away a portion of the bony envelope surrounding the sequestrum, which was readily removed. The sequestrum consisted of the whole thickness of the radius; it was two inches long. After taking away this piece of bone the wound in the patient's arm gradually healed, and he left the hospital cured.

In this case it is probable that in consequence of the injury which the man had received, a portion of the medulla of his right radius was contused. The patient was in a low state of health at the time of the accident, and the circulation in a limited area of the interior of the injured bone was not properly re-established after the contusion, and consequently this portion of the bone died.

In a case of the kind, the entire thickness of one of the long bones having died, including, of course, the medulla which it contained, it is evident that new osseous tissue could only be formed from the periosteum covering the exterior of the necrosed bone, and from the medulla contained in the healthy shaft of the bone at either end of the sequestrum. The dead bone, however, under these circumstances interferes with the healthy nutrition of the neighbouring osseous tissues, and the consequence is rapid and feeble cell-growth from the living cells surrounding it. Much of this superabundant cell-formation is unable from its physical circumstances to reach maturity, and degenerates into pus, which ultimately finds vent through sinuses, such as that which existed in this patient's arm before we operated upon it The periosteum enclosing the necrosed bone continuing to live, and its supply of blood being kept up from vessels contained in the neighbouring soft parts, as in the case of a simple fracture, a layer of new bone is formed round the seat of injury; but, unlike a fracture, in necrosis the exciting cause which produced the increased action in the periosteum, and growth of bone from it, continues, and so the external layer of new osseous tissue surrounding the piece of dead bone increases in bulk until it forms a thick case over the sequestrum, with openings in it here and there through which matter from the deeper parts of the suppurating surface can escape. In the instance under consideration it was necessary to break through this newly-formed bone before we could extract the necrosed piece. After the sequestrum had been taken away, the source of irritation in the part being removed, healthy action took place from the medulla and periosteum in proximity to the cavity formerly occupied by the dead piece of bone, so that this space was gradually filled with new bone.

I must refer you to my first Lecture for an account of the growth of bone; its repair after an injury, or when a portion of it dies and is removed from the body, is effected by the same agency, and by a similar process to that by means of which its ordinary disintegration is repaired. We sometimes have an opportunity of watching the growth of new bone from the soft structure contained in the cancellated tissue after the outer covering of the bone has been removed.

H. C. Jeffrey, aged three and a half, was run over by an omnibus, one of the wheels passing against the right side of the child's head. A portion of the scalp was torn away from the skull, the whole of the parietal part of the temporal and frontal bones being exposed and denuded of pericranium. The flap of skin subsequently sloughed, leaving the bare bone uncovered; in the course of two months thin plates of the external layer of the injured bone began to exfoliate, in consequence of a deficient supply of blood, from the loss of the soft tissues covering the skull; at the same time, small patches of a florid new growth sprouted up from the tissues contained in the diploë and remains of the outer table of the skull. These new growths coalesced, and over their surface a layer of connective tissue formed, beneath which ossification took place, the outer layer, or that farthest from the circulation, becoming organized into fibrous tissue, the deeper layers into bone, in precisely the same manner as the bone was formed during and after fœtal life. As the new bone was produced, the scalp round the edges of the wound grew inwards, and so the injured bone was ultimately covered by a healthy cicatricial tissue.

No doubt the favourable result in this instance was due to the peculiar nature of the exposed and injured bone, and also to the tender age of the patient. In adults the termination is often different, as in the case of A. E., aged fifty-six; this man, four years ago, fell into the fire and burnt the back of his head, the result being extensive sloughing of the scalp. In the course of a couple of months a nearly circular surface of the skull, five inches in diameter, was laid bare, exposing the posterior angles of the parietals, with the upper part of the squama of the occipital bone; this surface of bare bone has remained exposed for four years without undergoing much change, a putrid discharge constantly oozing from under its edges. In one or two spots the outer layer of dead bone has broken down and a florid growth from beneath has filled the cavity thus formed, but as yet the necrosed outer table of the skull is firmly united to the soft tissues beneath, and I am therefore disposed to follow the rule of treatment generally applicable to dead bone, which is not to attempt to remove it until the necrosed bone is felt to be detached from the tissues amongst which it is situated—a rule, however, not wanting in exceptions, as I have illustrated in the instance of the patient referred to in this Lecture, from whose arm I took away a sequestrum. The fact is, in operations for the removal of dead bone, as in almost all other matters connected with the practice of surgery, we must be guided more by common sense and the circumstances of each case as it presents itself to our notice, than by any fixed rule. The disadvantage of taking away dead bone before it has become loose in the surrounding structure is, that it is often impossible to determine, until the diseased bone has separated from the living, how far the necrosis may extend. It is much the same as in gangrene of the limbs; it is seldom desirable to amputate unless a distinct line of demarcation has formed between the dead and living portions of the limb, obviously because if we act otherwise our amputation may be short of the mark to which the gangrene will ultimately extend, and so another operation may be the least of the risks likely to result. It is the same with necrosis of the bones: if the separation between the dead and living bone has not taken place, it is generally advisable to wait until the sequestrum is detached, and can be moved either by means of a probe or the finger passed down upon it through sinuses in the surrounding soft structures. As a rule, necrosed bone is white, but if exposed to the air through open sinuses it may become of a dark or even black colour.

It is useless entering into details regarding the method to be employed in removing a bit of dead bone. Having satisfied yourself that the sequestrum is detached, or having reason to believe that although you cannot feel it loose in the wound, dead bone exists, which requires to be taken away, cut down upon the diseased bone; it may be through a layer of new osseous tissue which has formed round it, in which case strip back the periosteum so as to preserve it, and then take away the dead bone with the most convenient instrument at hand. In operations of this kind you will find Esmarch's bandage of assistance, enabling you to distinguish between the dead and living bone more clearly than if the parts were bathed in blood during the operation. The wound should be plugged with dry lint, and subsequently carbolized oil, the red lotion, or any other dressing you prefer, applied, the limb being kept at rest on a splint during the time the healing process is going on.

In the case of A. E., I adopted a course of treatment which is useful in instances when the dead bone is exposed. It consists in applying a strong solution of sulphuric acid (six parts to one of water) over the surface of the bone, as recommended by Mr. G. Pollock, our object being to dissolve away the outer shell of the necrosed bone; but in doing so be careful not to destroy the living tissue beneath, from which alone the reparative process can subsequently proceed. In the ordinary course of things we find that reproduction of bone in cases of necrosis of the flat bones is rarely met with, except in young subjects, as in the instance I have referred to. The formation of new osseous tissue after death of a portion of the skull is difficult, because the deeper layer of the pericranium and the medulla of the diploë having usually been destroyed in the diseased action or accident, there are no elements left in the part from which fresh bone can be produced.

The same fact applies to cases of necrosis of the ilium. We had an instance in point in Chadwick ward for some time—a poor girl, aged twenty-two, suffering from necrosis of the dorsum ilii. I cut down to the bare bone and removed a portion of it. We tried all the means at our disposal to relieve the symptoms, among others the application of sulphuric acid to the part as above described, but to no purpose. I have watched cases of this kind for years, but I do not remember meeting with one that really recovered. The sinuses may heal up, and all appears for a time to be doing well, but before long evidence of further bone mischief manifests itself, and so the case comes back upon our hands; suppuration continues, and ultimately tuberculosis of the lungs or some of the internal organs most probably kills the patient.

The notes of the following case, which were kept for me by Mr. C. T. Wise, further illustrate the symptoms and changes in one of the long bones, after the greater portion of its diaphysis has become necrosed. S. W., aged six, was admitted into hospital on August 10th. Her family history was good. The patient's father and mother are healthy, well-to-do people residing at Chelsea; she was one of nine children. Some three months before coming to hospital, S. W. received a severe blow across the upper part of her left leg, followed by inflammation of the limb; matter formed, which was subsequently evacuated, and drainage tubes were introduced into the limb. The child is said to have suffered from high fever, and an abscess formed in her left axilla.

During my absence the patient was under Mr. Gould's care, and was admitted into the Chadwick ward. Free incisions were made into the inflamed leg; effectual drainage was provided, the wound being treated on Listerian principles, nevertheless, the child's temperature was seldom under 102°, and she suffered from intense pain in the leg. No dead bone could be detected.

When I first saw this patient on September 25th she was extremely anæmic, with a rapid small pulse, constant and severe headache, great restlessness, diarrhœa, and some enlargement of the liver; there was no albumen in the urine. S. W.'s left leg was very much swollen and extremely painful, with openings through the skin on either side of the limb, through which a considerable quantity of pus constantly flowed. I could detect no dead bone, but there was evidently considerable periosteal new bone formed round the shaft of the tibia. The patient's knee-joint was not implicated in the disease. On October 1st her right hip-joint was found to be intensely painful and swollen, and a deep blush over the skin, evidently another abscess (probably of septic origin), was forming either within or immediately outside the joint. Under these circumstances, and considering that albuminoid enlargement of the liver existed, it was evidently necessary to remove the diseased bone as soon as possible. On October 1st, S. W. being under the influence of ether and an Esmarch's bandage applied, I made a free incision along the anterior surface of the limb; no bare bone was detected. The periosteum was then separated from the diaphysis and from the upper epiphysis within a short distance of the lower extremity of the bone; in this latter position the shaft of the tibia was cut through, and the diaphysis, which was separated from the epiphysis (from the effects of the disease which had been going on between the two), was readily removed from its position. The leg was kept quiet in a splint, and the wound simply covered with lint soaked in carbolic oil. From the time of the operation the fever left the child, and her condition steadily improved; the threatened suppuration in or about the hip-joint subsided. She has now, three months after the operation, a thick, well-formed tibia; the wound has entirely healed; she has some shortening of the limb, but free movements of the knee-joint.

On examining the shaft of the tibia removed from this child's leg, we notice that its outer surface is nodulated, and evidently covered with a case of new bone, formed from the periosteum; on its posterior surface there is a cloaca or passage into this sheath of new bone, and through this opening a portion of white and denuded bone can be seen. The upper extremity of the diaphysis—that is, where it had joined on to the epiphysis—was extensively necrosed. On making a section through the diaphysis from above downwards, we see that the greater part of the original shaft of the tibia was dead, and bathed in stinking pus. The necrosed bone is surrounded by a thick sheath of new bone, which is grown from the periosteum, and there is only one opening through this sheath, which, as I have already remarked, is situated on the posterior surface of the bone, and consequently could not be felt by us while the tibia remained in its natural position.

We need not now discuss the nature of the disease which led to the necrosis of the greater part of this tibia; it may have commenced at its junction with the upper epiphysis, perhaps in inflammation of the periosteum, or from injury inflicted on the medulla by the blow which the child received. Doubtless a sequestrum, such as that exhibited in this specimen, may in time break down and pass away with the discharges, or become absorbed; but, as is demonstrated by this bone, the process must necessarily have been a tedious one, and in the meantime the patient, in all probability, would have succumbed to the disease. Amputation of the limb, therefore, or the removal of the whole of the diseased tibia, would be the only means for us to adopt. The latter proceeding, as the history of the case demonstrates, has been eminently successful.

I may here refer to necrosis resulting from the local action of phosphorus on the osseous-producing element of the periosteum and bone: that the deleterious influence of this substance depends upon its being brought into contact with these particles of living bone is demonstrated by the fact that as long as persons working in the fumes of phosphorus possess sound teeth their jaws remain healthy, but if they happen to suffer from dental caries, by which the tooth pulp is exposed, the phosphorus gains access to the subjacent periosteum and exerts its baneful power on the cells contained in its deeper layers.

The disease first manifests itself by pain and localized swelling of the gums, often referred by the patient to toothache. If the phosphorus fumes continue to be inhaled the pain in the jaw increases, becoming very severe, sympathetic action is excited along the nerves of the face, neck, and head, swelling and suppuration of the gums follow, and after a time sinuses leading down to dead bone are established, and in this way considerable portions of the upper and lower jaws may be destroyed. The conditions which directly influence the progress of the disease are the continued exposure to the phosphoric fumes, the state of the teeth, the general health, and the hygienic circumstances under which the patient lives.

On examining specimens of these necrosed jaws we find the superficial portion is invariably of a dark or dingy colour; the outer layers of the bone are destroyed, and the spongy portion of the alveolar process is exposed. The bone looks rough as if carious; it is filled with pus, and as it discharges, small pieces of bone escape, which give the pus a gritty appearance. Examined microscopically we find these diseased bones afford evidence that ill-formed osseous structures had been produced in considerable quantity by the periosteum, and that the medulla occupying the Haversian canals and cancellated tissue of the bone had been destroyed; the increased action set up in these parts in all probability having been similar to that which occurs in the periosteum, but being carried on in unyielding passages the vessels have been compressed, and the circulation so far impeded as to lead to the death of the bone. On the other hand, the periosteum being supplied with blood by vessels contained in the soft tissues external to it, it builds up layer after layer of bone. No doubt the presence of the dead bone keeps up a disturbance in the nutritive changes of the parts, for if it is removed the periosteum does its work more perfectly, and produces a very fair osseous substitute for the bone that has been destroyed by disease.

Necrosis from phosphorus therefore presents nothing peculiar in the course which it runs. It is rather remarkable in consequence of the idea it seems to inculcate of the elective affinity between certain elementary substances and definite forms of living cells. Phosphorus fumes must be absorbed into the bodies of workmen employed in the manufacture of lucifer matches, and yet it appears to do them little harm unless they suffer from carious teeth; it may be the phosphorus becomes altered in the circulation, but it seems to be almost innocuous, unless brought into contact with the living descendants of the embryo cartilage-cells: it fixes upon them to the exclusion of the surrounding living matter, and evidently incites, if we may so say, these cells to ill-adjusted action, and so disease is set up such as I have described.

We cannot be too careful, in instances of necrosis from phosphorus, to insist upon the removal of the patient from the influence of this substance in any shape or form: his mouth must be washed out frequently with a solution of Condy, or carbolic acid; in fact, kept as clean as practicable. If the patient cannot chew with comfort he must be carefully fed on soup, milk, and vegetables, so as to improve his general health.

I am not an advocate, in this or in any other form of necrosis of the jaw, of making free incisions down to the diseased bone, unless it has separated from the living bone; we must have patience, simply removing decayed teeth and dead and loose bone, although in the meantime our patient has to suffer months, and it may even be years of discomfort and annoyance. I have more than once, in instances of necrosis of the jaw not depending on phosphorus poison, endeavoured to take away the diseased bone before it had completely separated from the living structures around it: the temptation is great to resort to treatment of the kind, for the disgusting odour and discomfort persons suffering in this way have to undergo are extreme; nevertheless, take my advice and refuse, unless under some peculiar or exceptional circumstances, to interfere either with the knife or forceps until the sequestrum is detached from its surroundings. And remember that great induration of the side of the face, one or more sinuses leading down to the upper or lower jaw, and long-continued and most painful disease of this kind, frequently depend upon a small portion of necrosed bone connected with the fangs of a diseased tooth; remove this, and the parts soon resume a healthy condition.

Mr. Salter has occasionally met with necrosis of the jaws, the result of the eruptive fevers—generally scarlatina; but I think it more frequently occurs after measles. I have seen several cases of this kind. It commences, after the active stage of the disease has passed off, in tenderness of the gums, fœtid breath, but no severe inflammatory action; the gums recede from about the teeth, and bare bone is exposed; this exfoliates after a few weeks, leaving a gap in the jaw, which gradually fills up with new bone. Mr. Salter considers this form of necrosis to be similar in its nature to that produced by the fumes of phosphorus, "the poison being, however, generated in the system, but having affinities for definite structures and tendencies to action upon certain organs, which give its morbid consequences an equally local character." Necrosis, under these circumstances, must, however, be of rare occurrence, considering the number of children afflicted by the eruptive fever who escape any such accident; and, fortunately, when it does happen it seldom extends beyond the *locale* containing the developing permanent teeth, the base of the jaw rarely being involved in the diseased action.

I have seen not a few cases of necrosis of the jaws among the natives of India, arising from inflammation of the gums, the result of over doses of mercury; in the same way, cancrum oris, especially among children, leads to death of the maxillary bones through the destruction which it causes to the periosteum and adjacent tissues, and so preventing the normal blood-supply of affected bones.

We occasionally meet with instances of necrosis, which run much the same, although (from the construction of the osseous tissues) a slower, course than senile gangrene. Mr. W. Morrant Baker brought an instance of the kind to the notice of the Medico-Chirurgical Society on February 27th, 1877. His patient was a man who was quite well ten weeks before admission into St. Bartholomew's Hospital, when he began to suffer from deep-seated pain, soon followed by a slight swelling in the left thigh. These symptoms gradually increased, and some six weeks after the commencement of his illness, while walking, a fracture of the middle of the femur occurred. The thigh became much swollen, the integuments were natural, and no abnormal condition of the soft parts between them and the tumour of the bone could be discovered. There was great pain in the limb, and the case was taken to be one of malignant tumour of the femur. Amputation at the hip-joint was successfully performed, and the patient left the hospital cured.

On making a section of the femur it was found that nearly the whole of the shaft was necrosed, "except at its posterior and upper part, where the bone is sclerosed and much enlarged, but not dead; while as suggesting a possible reason for this, there lies (exposed, as it happens, by the section) the canal for a large nutrient artery, the calibre of which has not been interfered with." The necrosis hardly extended to the trochanters; the condyles were hypertrophied. The shaft of the femur, from above the cartilages of the condyles to the trochanters, around its whole circumference, was contained in a thick envelope of newly-formed osseous tissue produced from the periosteum.

This is an example of a class of cases which we meet with from time to time of necrosis of bone without suppuration. Sir James Paget, referring to an instance of the kind, remarks that "the central point of interest in these cases is, I think, the fact of necrosis leading to separation of bone being unattended with inflammation of any of the textures external to the periosteum, or with more than a scarcely discernible amount of suppuration around the sequestrum."

I have already referred to the condition of a patient suffering from inherited syphilis, in which we found the lower end of the tibia much enlarged from newly-formed periosteal bone, and in which necrosis was progressing without inflammation at the time we amputated the limb. When lecturing on this case I remarked that one of the characteristics of these syphilitic affections was that death of the bone was apt to take place without suppuration, for reasons which I explained to you.

Necrosis of the whole or a portion of one of the long bones may also occur without the formation of pus in cases of embolism of the nutrient vessels of the bone; it may be the principal artery or some of the smaller vessels become plugged, but embolism of these arteries has been demonstrated, and the natural consequence of such an accident occurring in a structure like bone is the death of the part previously supplied by the plugged vessel, in the same way as necrosis of the kidney takes place after embolism of the renal artery. The evidence afforded by the history of some of the cases I have referred to seems to point to embolism of the principal nutrient artery, from the fact of the bone supplied by this vessel being generally necrosed, whereas the ends of the femur receiving vessels through the periosteum remain unaffected; for instance, in the case of necrosis without suppuration above noticed, the only part of the shaft of the femur not necrosed was a portion of the bone under the influence of a nutrient vessel, "the calibre of which was not interfered with." Then again, the rapid and very abundant periosteal growth noticed in these cases points to the conclusion of embolism, an extensive collateral circulation under the circumstances being established, which would necessarily induce hyperaction of the whole of the periosteal vessels of the shaft of the bone, and congestion of these vessels means increased growth of the periosteal osseous-forming elements, and so the development of the thick envelope of bone in which the shaft of this femur was encased.

It may be well for me to repeat the warning I have already given you not to judge hastily of the nature of the disease leading to rapid enlargement without suppuration of one of the long bones, or to pass to the conclusion that an affection of the kind depends either upon ostitis or on malignant disease, for these symptoms may clearly also depend, among other causes, on syphilitic affections of the periosteum, and also on embolism of the nutrient artery and other vessels supplying the bone.

LECTURE XI.

EXOSTOSIS—CYSTIC AND VASCULAR TUMOURS OF BONE—OSTEOID CHONDROMA.

Exostosis.

The first case I shall bring to your notice to-day is an instance of one of the simplest forms of osseous tumour, consisting of an outgrowth of the epiphysial cartilage, which subsequently becomes ossified.

W. W., aged five years, was sent up from the out-patient department, and admitted into the Luke ward on March 12th. The child's mother was a well-o-do healthy woman, and our patient the picture of a rosy-cheeked country boy. His mother stated that from the time he was a year old she noticed a small, hard swelling, about the size of a pea, which we found had increased to be an oval, incompressible tumour, as large as half a walnut, growing from the inner surface of the upper epiphysis of the boy's left tibia; the skin could be freely moved over the tumour.

I divided the structures over the tumour, and cutting through its base with a scalpel, separated it from the epiphysis; carbolic acid was applied to the surface of the cartilage, from which the tumour had been removed. The wound healed rapidly, and the child soon left the hospital cured.

On examining sections of this tumour under the microscope we find it is limited on its outer or free surface by a layer of periosteum, containing an abundance of cells. Within this layer of periosteum was a remarkably fine example of embryonic cartilage undergoing fibrillation; we see the hyaline material of the cartilage divided into fibres, its cells becoming spindle-shaped, but they contain the descendants of the nucleus of the cartilage-cells, which, on the one hand, are capable of building up bone, on the other, of forming fibrous tissue. The cells of the inner layer of this stratum of cartilage are undergoing proliferation, and producing bone in precisely the same manner as we see bone forming at the line of ossification in the epiphysial cartilages; in fact, the periosteal layer I have described as composing the free surface of the tumour performs the same office as regards the increase in size of the exostosis as the epiphysial cartilage does towards the growth of one of the long bones. The central portion of the base of the tumour has undergone ossification, its bone-cells being extremely numerous, as we see in most specimens of freshly-formed bone, produced under the influence of an abnormal supply of blood. In this instance, numerous small vascular canals pass from the periosteal vessels into the tumour; these blood spaces are surrounded by bone-cells formed from the cartilage, arranged in a concentric manner, so as to produce Haversian canals and systems.

It is evident, therefore, that this small tumour was an outgrowth of the epiphysial cartilage, subsequently converted into bone. It is in reality a specimen of normal, but wrongly-directed, growth. Multiple and symmetrical tumours of this kind occasionally form over the body analogous to the supernumerary fingers or toes we occasionally meet with on the hands and feet.

Exostosis of this description can only originate among young persons before the epiphyses have ossified; they seldom increase to any very considerable size. The extremities of the tibia, fibula, humerus, and metatarsal bone of the great toe are their most frequent site; they are occasionally found near the attachment of tendons—as, for instance, of the adducted magnus, to the inner condyle of the femur. When growing in situations such as this, the exostosis is apt to be dragged from its point of origin by the action of the muscle, and so becomes pedunculated, but in their mode of growth and minute anatomy these pedunculated exostoses are of precisely the same nature as those above described.

If left to themselves these tumours, as a rule, cease to grow at the age when the epiphyses become ossified, for being a part of the epiphysis they follow the laws regulating its development and growth; they are painless, increase in size very slowly, and unless in the close vicinity of a joint cause the patient little, if any, inconvenience. Should they, however, implicate an articulation, desirable as it may be to remove the exostosis, you must be cautious how you interfere, the more so as these small tumours, when situated in the locality I have named, are liable to be covered by elongated bursæ connected with the articular synovial membrane. Under these circumstances it has been proposed to break the tumour from its attachment, and allow it to become absorbed without cutting down upon it. On the other hand, when the exostosis is well away from the joint, as in the instance of our little patient, and it has grown, for a tumour of this description, rather rapidly, it is well to excise it at once. After the removal of the tumour the surface of the epiphysis from which it has originated may with advantage be touched with carbolic acid or some other caustic, so as to destroy the layer of cells in the vicinity, and thus, if possible, prevent the formation of a nodule of cartilage in the site of the former growth.

I have met with several cases of exostosis in young persons such as those I have described, springing from the upper surface of the distal phalanx of the great toe. These patients, in the first instance, had complained of great pain if pressure were made on the affected toe-nail, and on examining the part the extremity of the painful toe was larger than that of the sound side; beneath the nail a small, smooth, hard growth could be seen, which, as it increased in size, raised the toe-nail from its attachments. In the course of several months the side of the toe-nail beneath which the tumour grew ulcerated in much the same way as we see in onychia, but at this stage of the disease the tumour beneath the nail can be distinctly defined; the part becomes extremely painful, so as entirely to prevent the patient from wearing a shoe.

In cases of this kind the toe-nail covering the tumour must be extracted, after which the exostosis may be excised with a pair of bone-nippers ; there is no occasion to remove the bone from which it grows. A horny growth, much resembling the nail, soon covers the end of the toe, and the patient suffers no further inconvenience.

IVORY EXOSTOSIS.

We have had the opportunity on several occasions of seeing a patient in Chadwick ward, suffering from an exostosis over the right superciliary ridge.

R. P., aged thirty-one, states that eighteen years ago he sustained a heavy fall which stunned him at the time. He believes, from the position in which he fell, that he must have struck his forehead, but there was no contusion or external injury of the soft parts. Some three years subsequent to this accident he noticed a swelling over his right eyebrow; it gradually increased in size, reaching its present dimensions in about three and a half years, without causing him any pain, but he then began to suffer from epileptic fits, which have been extremely severe, and repeated as often as three or four times a day. Under the influence of bromide of potassium these fits have lately diminished in number, but he finds his memory impaired, and he has become extremely weak—effects not uncommonly experienced among persons after a long continued course of bromide of potassium.

At present, occupying the position of the right frontal eminence, there is a smooth, bony tumour, three inches in diameter, growing from the frontal bone; its surface is uniformly convex and even, and the skin moves freely over it.

From the occurrence of epileptic fits in this case it is probable that a similar bony growth to that above described projects from the inner surface of the skull—a condition of things not unfrequently met with in cases of ivory exostosis.

As a rule these ivory exostoses grow from some part of the skull, their favourite site being over the superciliary ridge and the orbital plate of the frontal bone; they have occasionally been met with springing from the jaws and the external auditory meatus, also from some of the flat bones of the skeleton. They increase in bulk very slowly, and seldom reach any great size, though there are exceptions to this rule. They cause no pain unless they press upon nerves, and are inconvenient rather than dangerous, except when they happen to encroach upon the brain or some vital organ, as in the case above referred to.

With reference to the treatment of these exostoses, if springing from the skull: supposing we could remove a growth of the kind by means of the knife and the chisel—an attempt which has failed more than once in consequence of their extreme hardness—we might subsequently discover that we had only got rid of a portion, and that by far the least harmful part of the tumour; in fact, if you are consulted with reference to a case of ivory exostosis of the skull, leave it alone.

Mr. G. F. Field has lately recorded a case of ivory exostosis filling the auditory meatus on each side, in which he managed to bore through the small tumours, and so opened a passage down to the tympanum.

Instances of ivory exostosis, originating in the antrum of the maxillary bones, and also of the lower jaw, are by no means common; they are recognized by their slow and painless growth, extreme hardness, and smooth surface. Tumours of this kind have been removed from the jaws with success, in one case after an operation lasting three hours!

In recent works on pathological anatomy we find accounts of what are called spongy exostoses, most commonly springing from the superior maxilla, and sometimes from other bones of the skeleton. I cannot, of course, deny the existence of these exostoses, but I suspect instances of the kind are rare, if we exclude from our consideration (as we have every right to do) cases of syphilitic, sarcomatous, and enchondromatous disease of the bone. Nor is it possible, as I have remarked, to form an idea of the real nature of these outgrowths of bone from an examination of dried specimens; under these circumstances we may see a coral-like mass springing from the antrum and projecting outwards, but in the living subject the interstices of this hard growth were filled with, perhaps, a sarcomatous formation. Unless we have opportunities of inspecting these tumours in a recent state, it is difficult to say to what class they belong. There can be no question that the majority of bony tumours formerly described as fibro-cellular are now designated osteo-sarcoma. At the same time I have removed exostoses growing from both the upper and the lower jaw, when they had increased to such a size as to interfere with the comfort or health of the patient.

We have lately had an interesting case of an exostosis growing from the femur, in the hospital.

C. M., aged twenty-eight, was sent into the hospital by Dr. Ferris, of Uxbridge. It appears this patient, when ten years of age, was thrown and kicked by a horse on the right thigh. For a month after the accident the injured part was bruised and swollen; subsequently a hard lump formed at the site of injury, which gradually increased to its present size. This tumour of the thigh has caused the patient very little pain or inconvenience, and for some years past has not perceptibly increased in bulk.

On admission we found a dense, smooth exostosis situated on the inner side of the patient's right thigh, four and a half inches from the internal tuberosity of the femur, on the line of the femoral artery; it was about four inches long and five broad, and was firmly attached by a broad base to the femur.

I declined operating in this case, because the tumour was simply an inconvenience to the patient. He was able to carry on his business without trouble, and we had no right therefore to subject a patient to the risk of an operation, which, under existing circumstances, was not absolutely necessary. I have little doubt that had we attempted to remove this exostosis we must have exposed a large surface of the femur, and in all probability have opened the medullary canal, running the risk of osteo-myelitis and extensive disease of the bone; in fact, an amputation would probably have been the better proceeding. On the other hand, it is very probable the tumour will not increase in size; but if it does, and interferes with the patient performing his duties, we shall be justified in recommending its removal, provided we have the patient's consent to amputate the thigh if it is found that we cannot take away the tumour without the limb.

CYSTIC TUMOURS OF BONE.

Cystic tumours of bone are extremely rare, unless in connection with the jaws; in fact, with the exception of a few instances of hydatid disease in the extremities of the long bones, cysts, in the ordinary sense of the term, have very rarely been found in any bones excepting the maxillæ. The late Mr. Tomes studied the subject of maxillary cystic tumours with great care; he observed during the development of the teeth that the enamel is separated from the surrounding soft parts by a small quantity of serous fluid, which, under ordinary circumstances, escapes when the tooth cuts its way through the gums; but it occasionally happens that the tooth remains impacted in the alveolar processes of the bone; under these circumstances the fluid surrounding it increases in quantity, the tissues enclosing the tooth and the cyst in which it is contained augment in density, and so a bag of fluid forms in the substance of the bone. A fault of this kind may occur from the fact of a tooth being originally too deeply developed in the body of the jaw, so that it never reaches the surface of the gums, or its development may be arrested before it is cut; lastly, a tooth, before reaching the surface of the alveolus, may become misdirected in its growth, and thus never be successful in arriving at the free surface of the gums.

Faults of this description are more frequently met with in connection with the upper permanent canine than with any other tooth; the dentes sapientiæ, however, as well as all the other teeth, from time to time, have been found impacted in either the upper or lower jaw, enclosed in a cyst connected with the maxillæ, in the manner above described. I think the youngest case of the kind on record is that of a girl, aged thirteen years, one of her lateral incisors being embedded in the inter-maxillary bone above and behind the root of the central incisor. Probably the oldest patient affected in this way was a man sixty years of age. He suffered from a tumour the size of a pigeon's egg in his upper jaw, which for many months closed the nostril of that side. It was caused by the expansion of a cyst round the second pre-molar, which was impacted deep in the substance of the jaw.

In the majority of these cases the patient has suffered from a slowly-increasing, almost painless tumour, which has often grown to a considerable size, and which is evidently connected with one or other of the maxillary bones. On examining the mouth the tumour may be seen projecting into it, and if the tumour is not very large we may be able to discover that one of the permanent teeth is wanting, and has never made its appearance above the gums. The soft structures covering the tumour usually appear to be healthy, or it is possible the cyst may have burst, and a fistulous opening has formed leading from the surface of the skin, or the mucous membrane of the mouth, into a cavity in the bone. On manipulation we readily perceive that the tumour is due to an expansion of the bone, and we may be able to detect fluid in it; its walls are, perhaps, so thin as to be elastic and are indented on pressure, bulging out again to their former shape with a peculiar crepitation when the pressure is removed. But in a case of the kind I had under my care a few months since the tumour felt almost solid to the touch, and neither fluctuation nor crepitation could be felt on manipulation; but there was the history of a slowly-increasing, painless tumour expanding the anterior part of the left lower jaw to the size of a hen's egg. The patient's left canine tooth was said always to have been absent—it had not been extracted; being, however, in doubt as to the nature of the growth, I pierced the walls of the tumour from within the mouth, and the point of the knife having entered a cyst, I opened the tumour freely and removed with my finger some solid material which it contained.

If in doubt in a case of this kind, it will be always advisable to make an exploratory opening before proceeding to further treatment. Supposing we have to deal with a dentigerous cyst, our object will be to remove the enclosed tooth (if there be one), or the contents of the cyst, whatever it may contain, and then the cavity will gradually close.

It is seldom that a case of the kind, cannot be cured without injuring the cheek. The walls of the cyst should be cut through from the mouth with a scalpel, bone-pliers, or, if necessary, with a saw. The cyst having been freely opened, its contents must be removed, after which the cavity may be plugged with lint, the dressing being changed from time to time until the jaw contracts, and the disease is thus cured. In the case above referred to this plan was adopted, and the patient made an excellent recovery, although it took nearly three months for the bone to return to its present size, which is hardly larger than it would have been in the normal condition.

A remarkable instance of a tumour occupying the alveolar ridges of both the upper and lower jaws, and projecting backwards over the hard palate, has lately been under my care. The patient was sent to me by

Dr. Woodward, of Puckeridge. This lad is fourteen years of age, the son of healthy parents. His father states that the boy's first set of teeth were very irregular; in fact, only three or four of them ever appeared, but until his son was ten years of age he attended school, and there was no perceptible growth in his mouth such as that which now exists. The tumour has increased in size very slowly, and has given the patient no pain, but latterly it had grown to such an extent as not only to interfere with the boy's articulation, but prevents his taking anything more than liquid food.

On examination we found a tumour occupying the whole of the free surface of the upper and lower jaws; it was firm in consistency, with rounded edges, and projected both forwards and backwards into the mouth; the tumour was covered for the greater part with healthy mucous membrane, with three or four irregular teeth projecting through it. I consulted Dr. J. Walker, our dental surgeon, regarding the case, and he agreed with me that this was an instance of an irregular or abortive growth of almost all the teeth in both jaws. The first set of teeth had appeared very irregularly, and the second set had remained almost entirely undeveloped in the alveolar processes of the jaws. The irritation which these undeveloped teeth had excited in the alveolar processes had produced the outgrowth of the gums and bone, which had consolidated and formed the bulk of the tumour projecting into the lad's mouth.

It was proposed to cut down and remove the imperfectly-formed teeth from the jaws, but up to the present time the lad's father refuses to consent to the operation.

There are a few instances on record in which cysts containing a supernumerary tooth have been found in the antrum of the superior maxillary bone. It is well that you should be aware of the fact that cystic tumours in this locality have arisen from this cause, but cases of the kind are so rarely met with that they belong rather to the curiosities of pathological anatomy than to that of clinical surgery.

Hydatid cysts, as I have already remarked, are occasionally found in the cancellated tissue of bones. Cysts of this kind gradually expand the osseous structures in which they grow, causing the patient but slight pain, and slowly increasing in size; the tumour sometimes communicates to the fingers, when pressure is made upon it, the peculiar crackling sensation belonging to osseous cysts with thin walls. In a case, however, reported by Mr. Keats, in which the hydatid cyst formed between the table of the frontal bone, the osseous walls were so dense that they were not indented by pressure. The nature of the growth can only be determined by tapping the cyst, and examining some of its fluid contents for the scolices of the echino-coccus. Under any circumstances, tumours of this description should be treated in the same way as dentigerous cysts, their contents must be evacuated, and the cavity of the bone painted over with a

40 per cent. solution of carbolic acid, and then filled with lint, so as to excite suppuration and destruction of the walls of the cyst, after which we may fairly hope that the cavity in the bone will be filled up with new osseous tissue.

Hydatid cysts, however, are a very rare form of disease, but distention of the frontal sinus with fluid is more common; it seldom happens, however, that the cavities on both sides are affected. Mr. G. Lawson has demonstrated that the majority of these cases depend upon an accident, or some cause by means of which the passage between the sinus and the corresponding nostril has become closed. This channel being occluded, the secretion from the lining membrane of the frontal sinus accumulates, and gradually distends its walls.

The symptoms produced in cases of the kind will vary with the rapidity with which the secretion collects; in some cases the distending force is so gradual that the patient complains of little, if any, pain in the part, but simply of a slowly-increasing tumour at the upper and inner angle of the orbit, which, as it increases in size, forces the eyeball forwards and downwards. In the more acute cases these symptoms are accompanied with severe pain at the root of the nose, and the skin covering the advancing growth becomes red and inflamed.

In the treatment of these cases our object must be to re-establish an opening from the affected frontal sinus into the nose.

An incision should be made parallel with the fold of the upper lid, through the skin and subcutaneous tissues down to the tumour, which must then be freely laid open so that the surgeon can introduce the tip of one of his fingers into the cavity and remove any dead bone or anything else it contains. With a pair of polypus forceps a passage must be forced through the plate of bone separating the sinus from the nose: a drainage tube may then be inserted through this opening, one end of the tube passed out of the corresponding nostril and its other end secured to the forehead: in this way we may hope to form a permanent fistula from the frontal sinus into the nostril. The drainage tube may subsequently be withdrawn, and the external wound allowed to heal. Several of Mr. Lawson's cases treated in this way have made very good recoveries.

VASCULAR TUMOURS OF BONE.

Mr. Stanley and other authorities have described vascular tumours of bone under two heads, "cystic blood-tumours" and "pulsatile vascular tumours of bone." The more closely, however, we examine specimens of the kind and the histories of the cases from which they were taken, combined with one's own experience on the subject, the clearer it becomes that the morbid appearances referred to are the result of pre-existing myeloid disease. In fact, we know perfectly well that sarcomatous growths, especially the myeloid form, are very apt to degenerate into cyst-like cavities which become filled with blood, forming, in truth, blood-cysts. The importance of bearing this fact in mind is obvious, because if we were to treat a tumour of this description in the manner described for the cure of dentigerous cysts, the chances are, we should not be able to stop the bleeding from the cyst without amputating the limb. So that if you meet with a tumour of bone, other than those connected with the upper and lower jaw, which is cystic in its nature, and on puncturing it with a grooved needle or fine trocar you find that it contains blood and soft gelatinous material, you may presume that you have a myeloid growth to deal with, and you must manage it accordingly.

Although the origin of blood-cysts connected with bone is generally such as I have described, nevertheless we must bear in mind the fact, that after an injury blood may be effused into the periosteal or into the cancellated tissue of a bone and form a hæmatoma. As an example, we may instance what sometimes occurs in parturition from pressure of the fœtal head during its passage through the pelvis. The vessels beneath the pericranium are ruptured, and a large soft elastic swelling may be found on the child's head at the time of birth, over one of the parietal bones. The pressure of this clot may interfere with the process of ossification of the bone beneath it, and at the line of separation of the pericranium from the skull a ridge of bone is sometimes produced, resembling in its nature a provisional callus. As the clot becomes absorbed the rim of newly-formed soft bone remains, giving one the impression that there is a hole in the skull occupying the space formerly covered by the clot; this condition does not arise from a depression in the bone, but from an osseous ridge produced in the manner I have described. In the course of time the laws governing the symmetrical growth of the body gain the supremacy, and the new bone ultimately disappears like the provisional callus.

With reference to the second class of vascular tumours of the bone, we have even less hesitation than in the case of cystic tumours in pronouncing them to be due to sarcomatous or carcinomatous disease. Tumours of this kind are often extremely vascular, and, if situated near one of the large vessels, are apt to pulsate in a remarkable manner. On applying the stethoscope to the part, a well-marked bruit may sometimes be heard, so as to lead to the impression that the tumour is due to an aneurism.

One of the most remarkable cases of this kind I ever met with occurred in the instance of a patient who had fallen and struck the lower part of her back against a box. Some three months after the accident she began to complain of severe pain in the left gluteal region, supposed at the time to be due to sciatica. When I saw her two months after the commencement of the pain, there was some fulness over the gluteal region; but it was not until a month later that the swelling became very apparent, and a distinct pulsation could then be felt in the part, and on applying a stethoscope over the swelling a bruit was audible: the patient had fallen off rapidly in flesh and had a marked cancerous appearance. The late Sir W. Fergusson subsequently saw the case with me, and we arrived at the conclusion that the symptoms were due to a carcinoma originating in the dorsum ilii. He related the circumstances of a patient formerly under his care in King's College Hospital, which resembled the condition presented by this person in a very remarkable manner.

This case illustrates the clinical history of the majority of pulsating tumours of bone which we meet with in practice. They are not always so obscure in the early stages of the disease as this was, in consequence of the thick covering of soft tissues which intervened between the tumour and the surface of the body; we must bear in mind the fact that pulsating tumours originating in bone may be myeloid in their nature. Perhaps the favourable results which have been reported as occurring after tying the brachial and femoral arteries for the cure of pulsating tumours connected with the radius and also with the head of the tibia, were, in truth, instances of myeloid disease. We may have great difficulty in determining the nature of such a tumour, although in the living subject we may have examined a portion of it. As a rule, if the growth of a tumour connected with bone is very rapid, accompanied with the development of the cancerous cachexia, we should incline towards the belief that we have a carcinoma and not sarcoma to deal with. Nevertheless, the border-line between these is anything but a hard-and-fast one, and in the earlier stages of these tumours it may be impossible to arrive at a correct diagnosis. Mr. Stanley amputated a thigh on account of the existence of a cyst in the condyles of the femur, also involving the tibia; and the following history shows how difficult these cases are sometimes of diagnosis. The patient was admitted into St. Bartholomew's Hospital in October, 1863, under the care of Sir William Lawrence. For some months the knee had been swollen and painful, and was uniformly enlarged; it measured two inches more in circumference than the other. The swelling seemed confined to the joint, and yielded a sense of fluctuation. The surgeons of the hospital were divided in opinion respecting the nature of the disease, but thought most probably that it was pulpy degeneration of the synovial membrane. The limb was amputated, and on opening the joint it was found to be perfectly healthy. A cavity existed in the femur behind the patella, with nothing intervening but the articular cartilage. This cavity occupied the entire base of the articulating surface of the femur.

OSTEOID CHONDROMA.

Cartilaginous tumours originating in the medulla or deeper layers of the periosteum are, from a clinical point of view, similar to slowly-growing osteo-sarcomas. I have never yet seen a purely cartilaginous tumour originating in osseous structures; the osteo-chondromata, so far as my observations go, invariably contain elements, to a greater or less extent analogous to those found in ostec-sarcoma. Nevertheless, I have specimens of osteo-chondroma which are not sarcomatous tumours, and are exactly like the osteo-chondroma described by Ranvier, consisting of trabeculæ of various sizes, composed of a highly-refracting fibrillated basis containing angular corpuscles, similar to articular cartilage which is undergoing fibroid degeneration. These trabeculæ are separated by a fibrous tissue in which vessels run, and in this fibrous tissue are patches of cartilage.

Such enchondromatous tumours grow very slowly; they are painless, unless involving or pressing on nerves; the skin covering them is healthy, they are resistant to the touch. As they increase in size, portions of the tumour may degenerate into soft fluctuating cavities, which contain a brownish serous fluid, with softened tissue, but by far the majority of the morbid growths of this kind which have been described as osteo-chondromas are in truth osteo-sarcomatous tumours, for the former tend to ossify, rarely to degenerate into cavities such as are usually found in sarcoma. Some osteo-chondromas grow to a great size; for instance, we have the records of a case in which the shaft of the femur, from the knee-joint to within an inch of the trochanters, was involved in a cartilaginous mass three feet in circumference. In another case, the tumour growing from the femur measured no less than six and a half feet in its circumference.

The most common site of cartilaginous tumours is the phalanges of the fingers, when they are almost always multiple, next, the femur and pelvis. They are sometimes met with springing from the humerus, jaws, pelvis, and scapula, still more rarely from the ribs and basi-cranial bones. As a rule, those osteo-chondromas which are connected with the larger bones, such as the femur, originate in the periosteum.

Most of the osteo-chondromata make their appearance before the ossification of the bone from which they arise is completed, but as their growth is painless and always very slow, it may be some years after puberty before any notice is taken of the tumours; they are usually roundish, nodular, sharply bounded tumours, growing, as I have before remarked, to a great size, without affecting neighbouring parts or injuring the patient's general health, unless from the inconvenience produced by their bulk. Complete ossification of the tumour might occur, in which case it would cease to grow; but this is not the history of chondroma—on the contrary, they slowly increase, until, if left to nature, they reach an enormous size.

The osteo-chondromata are non-infective growths, and when from their size or other circumstances they become inconvenient, should most certainly be removed; there are few conditions under which a limb should be amputated for osteo-chondroma, before attempts have been made to excise the morbid mass with a portion of the bone from which it grows, unless its size precludes the possibility of the lesser operation, or the situation of the tumour, as in the instance of J. M., is such as to prevent our taking it away without sacrificing the limb at the same time; we must, however, bear in mind the fact that when of large size most of the osteo-chondroma surround the bone from which they grow.

LECTURE XII.

OSTEO-SARCOMA AND CARCINOMA.

J. M., aged twenty-four, was admitted into the hospital on March 27th. Her mother died when forty-five years of age, from some affection of the uterus. Her father was alive and well. She had brothers and sisters, some older, some younger, than herself, who were in good health. Our patient had four children, the youngest being only a month old when she came into the hospital.

J. M. stated that four years ago she felt a peculiar numbness over the right shoulder; after a time the part became painful, and she then noticed that there was a swelling over the region of the scapula, which had gradually increased in size, causing her great pain. She was consequently sent into the hospital by Mr. F. W. Butler, of Brighton.

On admission, a tumour, about the size of an infant's head, was found occupying the region of the right scapula. It projected forwards through the axilla, beneath the pectoral muscles; it also passed under the outer part of the clavicle. The tumour surrounded a considerable part of the shoulder, but the joint was not implicated in the disease. I thought I could detect the subclavian artery above the upper edge of the tumour, but the circulation through this vessel was impeded, for there was only a feeble pulsation in the brachial artery. The right hand and arm were œdematous.

The skin was not adherent to the tumour, and was apparently healthy, except in one or two patches, where it was red and inflamed; beneath these spots fluctuation could be felt, otherwise the whole mass of the morbid growth felt firm and hard; it was movable on the surrounding structures; no dilated veins could be seen coursing over it. There were no enlarged cervical or other lymphatic glands in the neighbourhood of the morbid growth. Our patient suffered from excruciating pain in the tumour, right side of the neck, and arm, which we could not relieve by morphia, chloral, or any other drugs. She urged me to take away the tumour at any risk.

J. M.'s child having been weaned, and her general health improved as far as possible, I proceeded to excise the scapula, together with the outer half of the clavicle and the right arm. I determined, in the first place, to tie the subclavian artery, and having to take away the outer half of the clavicle, I commenced the operation by removing about an inch from the central part of the bone. Having done this, I found a portion of the tumour passing upwards behind the scalenus muscle. I was unable to discover the artery, and it was impossible to waste time in searching for it, running the risk of wounding one of the large veins at this stage of the operation, so that the necessary incisions were made through the skin over the tumour, and having separated the mass from the surrounding tissues, it was turned forwards, together with the arm, over the chest, and was then readily severed from the body. The hæmorrhage during the last stage of the operation was great. The patient died on the following day.

There can be no question as to the desirability of dividing the clavicle in the first stage of an operation for the removal of the scapula and arm, and it is evident that if the subclavian artery can then be secured, the risk of severe hæmorrhage is diminished. But in the living subject, and supposing the vessel is in its normal position, it is by no means always easy to put a ligature round this artery, and if its relations to the surrounding parts are distorted by a morbid growth such as we had to deal with in this case, the difficulty of securing the subclavian in the third part of its course is much enhanced. We should, therefore, be prepared under these circumstances to abandon the attempt; it is impossible to waste time in searching for the vessel, the patient necessarily losing blood while we are doing so, and we must proceed at once to separate the tumour from its surroundings, and, thrusting it and the arm forwards, pass a ligature, if possible, round the subclavian, or, having the vessel securely grasped by an assistant, divide it the last thing before completing the separation of the parts from the body.

The question has been raised as to the propriety of taking away the scapula, arm, and half the clavicle, but I have the published records of thirteen cases of the kind, and in eleven of them the patient lived for upwards of six months after the operation; in two, death occurred directly from hæmorrhage or shock; so that, provided the case under our notice was a proper one to operate on, it was evident the removal of these parts was a measure warranted by previous surgical experience. I believe also that, if any operation was to be performed, nothing less than the removal of the parts I have mentioned was justifiable; had we attempted to preserve the arm, it was more than probable some of the morbid growth would have been left behind attached to the structures surrounding the upper end of the humerus, and so the disease would have reappeared in the wound. Further, from the patient's condition, worn out as she was with pain, it was needful to expedite the operation as much as practicable; while excising the tumour we should have been unable to afford the time to make an elaborate dissection of the morbid growth in the axilla, supposing we could even have done so without dividing some of the large vessels and nerves supplying the limb.

While considering the circumstances of the abscission of this tumour, we necessarily had to determine the nature of the morbid growth, and the probabilities of its recurrence after removal. In this case there was no enlargement of the lymphatic glands; the tumour was movable on the ribs, and was evidently isolated or separated in a great measure by a capsule from the tissue among which it grew; the skin was not adherent to the tumour, nor were there any large veins coursing over its surface. The patient's eye and complexion were remarkably clear; she had rather the appearance of a person suffering from hectic than the dull jaundiced hue of advanced cancerous cachexia; consequently, although the tumour had of late grown rapidly, and caused the patient intense pain, nevertheless, from the symptoms, and appearances it presented under the microscope (a portion of the tumour having been removed through a canula and aspirator), I had no doubt as to the growth being a round-celled sarcoma.

It was impossible for us to determine in this case, if after the removal of the growth others of a similar kind would not appear in different parts of the body, but we know perfectly well that large, slowly-growing sarcomatous tumours such as this have been removed, and the patient has remained free from the disease for many years, if not for life.

Had the neighbouring lymphatic glands been enlarged, or had there been evidence that the morbid process had infected the surrounding structures, and been not only a rapidly-growing but a very vascular growth, then our prognosis would have been unfavourable, and I should not have undertaken the operation, although the tumour was a sarcoma.

After removing the tumour, we were able to inject a small part of it through the subclavian artery, which we found imbedded in the mass, and from these injected and stained sections we may study the pathology of the morbid growth.

On cutting into the tumour, we discovered that the bone from which it had originally grown had almost disappeared; the head, neck, acromion process, and a part of the spine, all of which were covered with healthy periosteum, were the only portions of the scapula which remained. The bulk of the morbid growth was composed of cartilage, intermixed with masses of a structure known as the round-celled sarcoma, but which in places had softened, and broken down into cavities of an irregular shape. Scattered throughout the tumour were a number of spiculæ of bone.

However carefully we might examine sections cut from the bulk of this tumour, we should, I think, gain but a very imperfect idea as to its nature; but you will observe, as is almost always the case in osteosarcomas, the morbid growth appears to have stopped short at the dense lamina of bone which separates the cancellated tissue with its medullary contents from the articular cartilage. We find the spaces between the trabeculæ in the head and neck of the bone occupied by round-celled sarcomata. This condition of things extends up to the lamina of bone to which the articular cartilage of the glenoid cavity is attached (Fig. 5). To the naked eye this latter structure appears to be white, glistening, and healthy; but if we examine sections of it under a quarter of an inch glass, we discover that its cells

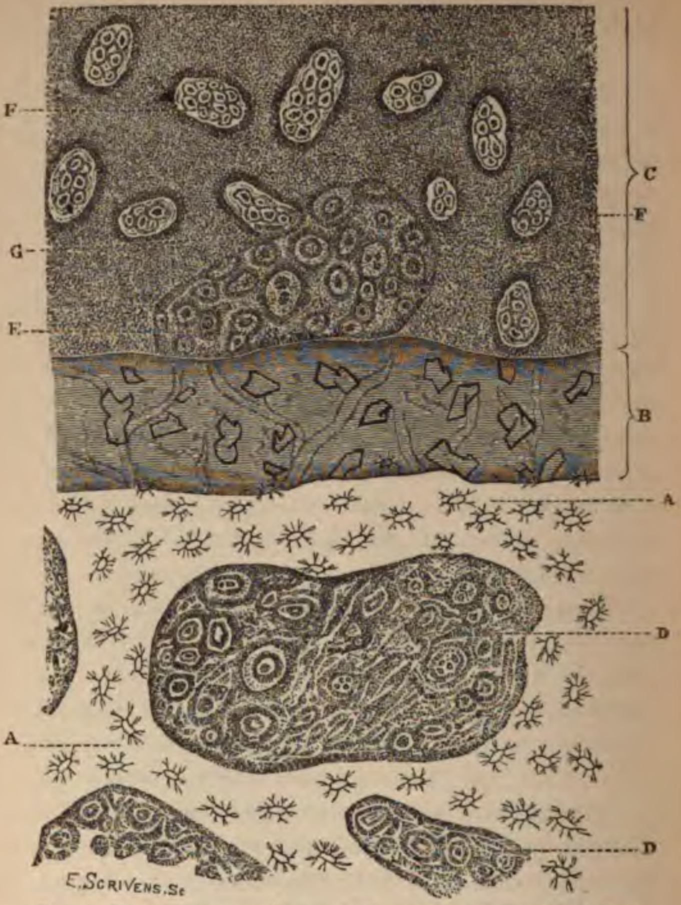

FIG. 5.—SECTION THROUGH ARTICULAR CARTILAGE AND SUBJACENT BONE IN A CASE OF OSTEO-SARCOMA.

The bracket C delineates the thickness of the articular cartilage.

The bracket B shows the hard lamina of bone separating the cartilage from the fully-formed bone.

A A, Bone-corpuscles.

D D, Cancellated spaces in the bone, the medulla they contained having been converted into a sarcoma.

E, Cartilage-cells undergoing transformation into sarcoma.

F, Isolated cartilage-cells undergoing changes into the compound (myeloid) cells of osteo-sarcoma.

G, Cartilage-cell passing into sarcoma.

are undergoing a peculiar transformation. The nuclei of these cartilage-cells have, in fact, undergone a process of proliferation, the contents of the original cell having divided into eight or more portions. Each of these subdivisions of the nucleus is surrounded by an area of soft granular matter constituting a cell, and these cells lie in a coarse granular material, so that each of the original cartilage-cells is, as it were, transformed into a giant-cell (myeloid). In many places we see the commencement of this process, in others the giant-cells have amalgamated and formed a patch of round-celled sarcoma, and I would have you particularly notice that the hyaline structure surrounding these cells is perfectly healthy; it contains neither vessels nor any trace whatever of disease.

You are aware that authorities on the subject hold that sarcoma commences "from connective tissue, as these are always vascular" (E. Wagner); but we have here an illustration of the fact that sarcoma may appear in a non-vascular structure by the transformation of its cells into an abnormal form. We see the nuclei of the cartilage-cells subdividing and growing into the cells characteristic of sarcoma. The abnormal change seems to be simply one of perverted growth taking place without the intervention of any visible external agency.

If the cartilage-cells undergo changes such as those I have described, it is reasonable to suppose that the cells of the medulla of bone might be affected in the same way. I have before explained to you that the round cells of the medulla are the descendants of the temporary cartilage-cell, inheriting the properties of its progenitors, and capable, therefore, of forming bone, or producing cartilage and connective tissue. We can understand, therefore, how it happens that, while this morbid growth has destroyed the scapula, there is a considerable quantity of new bone and fibro-cartilage formed throughout its substance. For instance, on examining sections through the neck of the scapula, we see its cancellated tissue full of sarcoma (Fig. 5), and as the integrity of the trabeculæ depends on the health of the medulla, so when this latter structure becomes diseased the bone rots away. On the other hand, cartilage and bone has formed in irregular patches throughout the bulk of the tumour, because the cells constituting the morbid growth have a tendency to revert to their normal functions and form bone; they are incapable of doing so in proportion as their perverted or diseased properties preponderate over their healthy action; and so some of these osteo-sarcomas contain a complete skeleton of bone, others large and irregular pieces of it, intermingled with patches of cartilage.

The osteo-sarcomatous have frequently been described as cartilaginous or fibro-cellular tumours, and so on, according as they presented certain appearances to the naked eye of the observer, but their histological characters, when carefully examined, are found to consist of either spindle-shaped, stellate, or round cells, each cell containing a large nucleus and nucleolus. The individual cells are surrounded by a homogeneous but sometimes granular inter-cellular substance, which occasionally assumes a finely fibroid appearance; it never takes on the form of the distinctly fibrous matrix of carcinoma. Osteo-sarcomas almost invariably contain myeloid, or giant-cells; in some tumours these compound cells predominate, especially in sarcomas originating in the medulla of bone, which are consequently called myeloid tumours. It is not uncommon in morbid growths of this kind to find the giant-cells separated from one another by bands of spindle-shaped cells. In any osteo-sarcoma either the round or spindle cells may be largely in excess, and such tumours are described as round or spindle-celled sarcomas. In other tumours these forms of cells are intermixed in various proportions, and such a growth is known as a mixed sarcoma. But whatever may be the predominating form of cell, osteo-sarcomas invariably contain a certain amount of cartilage, and in by far the greater number of them we find spiculæ of bone.

Like sarcomas growing from other parts of the body, those originating in connection with bones usually contain cavities, or cysts, as they are called, which may be filled with blood or with serous fluid containing the debris of the tissue in which the cyst was formed.

Osteo-sarcomas are generally classified under two heads, those originating from the periosteum and those commencing from the interior of the bone. No doubt in certain cases of sarcoma connected with the extremities of the femur, tibia, and humerus (the most common sites of origin of these growths), we may be able after death, or the removal of the tumour, to determine if it had originated from the periosteum or from the medulla of the affected bone; but in tumours involving the skull, pelvis, and scapula, such as in the specimens now before us, it is impossible to determine whether the tumour has commenced in the periosteum or the medulla of the bone. Attention has been drawn principally to this subject on account of the remarkable features presented by some of the osteo-sarcomas which have sprung from within the cancellated structure of one or more of the long bones. As the morbid growth has increased in size, it has expanded the periosteum, and this bone-producing tissue having subsequently ossified, the soft sarcoma, containing perhaps a large number of cysts, becomes enclosed by a thin layer of bone, forming the "spina-ventosa" of some pathologists.

From a clinical point of view it does not appear to affect the result of the case very much whether an osteo-sarcoma has originated in the periosteum or in the bone. As a general rule, those tumours commencing in the former situation grow with greater rapidity than those commencing in the latter. But osteo-sarcomas commencing in the medulla of the long bones are more frequently met with, especially after the adult period of life, than those originating in the periosteum. The round-celled sarcomas usually grow the most rapidly, which is equivalent to saying that patients suffering from this form of tumour are very likely to develop morbid growths of the same nature in various parts of the body. Our prognoses regarding cases of osteo-sarcoma, in fact, mainly depend upon the rapidity with which the tumour increases in size. Some of them take years to grow, and under these circumstances the probability of sarcomas occurring in the viscera and other localities is comparatively small, but in the case of rapidly-increasing tumours the reverse of this occurs, especially if they originate in connection with the upper part of the femur, humerus, or of the pelvis. There is one remarkable point in the clinical history of osteo-sarcomas which is, that in only about fifteen per cent. of these tumours originating in the periosteum, and perhaps not more than ten per cent. of those commencing within the bone, do we find the neighbouring lymphatic glands similarly affected. Doubtless, in instances of rapidly growing osteo-sarcomas we find similar formations not only in other bones of the body, but also in the viscera; these may be secondary tumours, but it is equally probable that they arise independently of what we suppose to be the primary sarcoma.

My reason for holding this opinion is, that osteo-sarcomas, as a rule, do not invade the soft structures among which they grow, being separated from them by a well-defined capsule of connective tissue; but it may be argued that although the primary growth does not extend along the lymphatics after the manner of carcinoma, osteo-sarcomas are disseminated by means of the blood; nevertheless, so-called secondary tumours may with equal propriety be assumed to originate independently from connective-tissue cells in various parts of the body, which are predisposed to take on the sarcomatous form of growth, from causes, whatever they may be, which have induced the primary tumour. We are at present in total ignorance as to the nature of these causes, for osteo-sarcomas do not appear to be specially connected either with injuries, irritation, or inflammation of the parts first affected, and where these tumours have been removed in the early stages of the disease, the patient may be free from a recurrence of the malady for years, and then it manifests itself in some part of the body having no connection whatever with the structures in which it first made its appearance.

Osteo-sarcoma occurs with equal frequency in both sexes and at all ages; it is hereditary in the same sense that carcinoma is; the disease may affect any of the bones of the body, but as one might expect is relatively of most common occurrence in connection with the extremities of the long bones, these portions of the osseous tissue containing a considerable quantity of medulla, in which the morbid growth develops.

It seems to me that osteo-sarcomas growing from the skull exemplify the idea I have endeavoured to inculcate regarding the origin of sarcomatous tumours. They not unfrequently communicate a sensation of pulsation to the hand, when placed over them, which pulsation is, however, for the most part communicated to them from the brain. A case of this kind was lately brought to the notice of the Pathological Society of London, by Mr. H. Morris. The patient first came under his care in August, 1874, being then forty years of age. Two years previously she fell and struck her head, and a small blood-tumour appeared, but vanished next day. A month later she noticed a small tumour over the left parietal bone, which in 1873 attained the size of a small apple. A second similar lump then rose up, and soon blended with the first. For two months before admission she had suffered from headaches. When Mr. Morris first saw her there was a very prominent, soft, pulsating tumour reaching to the middle line at the vertex, and forwards to the ending of the hairy scalp; it was fixed to the skull. Around its circumference a hard, raised rim of bone was felt; the skin was marked with distended veins, was freely movable over the tumour, and not ulcerated; pressure upon it caused no discomfort; there were occasional flashes of light; eye normal; cervical glands not enlarged. The tumour was punctured with a needle, and only a little blood escaped. In August, 1874, an expansile tumour was discovered just above the top of the sternum; no difference could be detected in the radial pulses. In December the tumours had grown a little, and the hard ring round the one on the head could only be detected in places; the temporal and supra-orbital arteries of both sides could be felt enlarged, and pulsating forcibly. The tumours slowly increased in size, and in November, 1878, another was noticed at the top of the right thigh, smooth, soft, and pulsating, and apparently produced by the expansion of the upper end of the femur; later on another was noticed in the left thigh; all the growths became extremely painful, and death occurred in October, 1878. At the autopsy a fifth tumour was discovered near the inner condyle of the right femur, and the thigh was rotated in as if dislocated. The tumour in the neck was found to be within the inner end of the clavicle, but not implicating the sterno-clavicular joint. A section through the tumour of the parietal bone showed that it was limited by the pericranium on the outer side and the dura mater within, and that springing from the diploë the tumour had spread out on both aspects of the skull, especially on the outer surface. In the centre the parietal bone was perforated for about an inch and a half, and the diploë was encroached upon more than either table of compact tissue; the tumour was growing over and not from the compact tables of bone.

The tumours growing from the clavicle and the femur were not examined, and it would evidently, therefore, be simply a matter of speculation to discuss their nature. Through the kindness of Mr. Morris, I had an opportunity of carefully examining specimens of the tumour growing from the skull: on section it presented a number of cavities lined with epithelial cells, and having a glandular structure; but the epithelium did not rest on a well-defined basement membrane, and the cells were separated from one another by a granular material. The stroma surrounding the cavities above referred to was constituted of a mixture of homogeneous material, vessels and fibro-cellular elements, containing numerous spaces, many of them lined with polygonal cells much resembling gland structures. The question naturally arises as to the origin of these structures. By several authorities it was held that the tumour could not be glandular, because it had originated within the diploë of the skull, and they were disposed, therefore, to discredit the idea of epithelial cells in the new growth. I think, however, if we consider the embryology of the parietal bones from which this tumour grew, there is not much difficulty in explaining its histology. These bones, as I have before remarked (p. 142), are dermal appendages, and, consequently, if from any cause the influence regulating their normal growth is perverted, the elements of which they are constituted have a tendency to revert to their primitive form; and so in this tumour we find tissues, partly belonging to the glandular structure of the skin, surrounded by a stroma of altered connective tissue.

The tumour, like many others growing from the skull, imparted a sensation of pulsation to the fingers applied to it, this movement being evidently communicated to the morbid growth from the brain; but osteo-sarcomas, growing from other parts of the body besides the skull, may have a pulsating movement imparted to them very much like that of an aneurism, especially those connected with the pelvis, the femur, and extremities of the tibia. These pulsating tumours are usually myeloid in character, and contain cavities, often filled with a red jelly-like material, or sometimes with a bloody serous fluid. In more than one instance tumours of this description have been mistaken for aneurisms, and the main artery of the limb has been tied with the hope of curing the disease. Mr. Stanley mentions several cases, such as the following:—

"A man, aged thirty-two, a pulsating tumour appeared at the inner side of the tibia, just below the knee. In a year from its commencement, the circumference of the tumour was about equal to that of the palm of the hand. Dupuytren tied the femoral artery in the middle of the thigh. The pulsations of the tumour directly ceased, but a few days afterwards they returned in a slight degree. The pulsations again ceased, and the tumour gradually disappeared. Seven years afterwards, the tumour re-appeared, and acquired a large size, but was without pulsation. Dupuytren then amputated the limb; the wound bled so profusely that twenty-four vessels required the ligature. The patient recovered. On examining the amputated limb, the tumour was found to be composed of numerous cysts; some filled with a gelatinous matter, others with coagulated blood. A fine membrane lined the cysts, through which vessels were abundantly distributed in the form of a close network."

A pulsating tumour originated in the lower part of the radius of a man, aged thirty-six years. M. Roux tied the brachial artery in the middle of the arm;

the tumour became flaccid, ceased to pulsate, and underwent no further change for five weeks; it then again increased with the return of pulsation. M. Roux amputated the arm. The radius, through its lower fourth, had disappeared; the pulsating tumour which occupied its place was composed of cells filled with blood.

Osteo-sarcomas sometimes increase in size very slowly; for instance, this cast was kindly made for me by Dr. Walker (our dental surgeon), from a patient of mine. When about three years of age a tumour, the size of a pigeon's egg, was removed from the alveolar process of his right superior maxilla. About nine years after the operation the morbid growth had re-formed; it was then excised, together with a portion of the bone from which it grew. But now, after a period of eight years, we see from this cast the tumour is of considerable size. It has moulded itself to the arch of the palate, and causes the patient but little inconvenience, and so I recommended that for the present it should be left alone; but this is an instance of a slowly-growing sarcoma, springing doubtless from the upper jaw; in fact, the upper and lower maxillary bones seem to be peculiarly liable to originate spindle-celled osteo-sarcomatous growths, and we find descriptions of them in most surgical works under the heading of "Cartilaginous or Fibro-cellular Tumours of the Jaw." Some of these reach a considerable size before they are removed; others only attain the dimensions of a small epulis, which is a common form of sarcoma, usually of slow growth. For instance, a patient in Luke ward, R. D., forty-five years of age, had a hard tumour, about the size of a cob-nut, growing from the alveolar edge of the lower jaw behind this left canine and bicuspid teeth, which teeth it had thrust somewhat forwards; it gave him no inconvenience whatever, and during the past seven years has not increased in size. The tumour had been removed once when the patient was a lad, and again ten years ago; the last time, the patient says, it was tied, and allowed to slough away. The only means of cure in a case of the kind was to extract some of the teeth, and excise the epulis with a portion of the bone from which it originated, a proceeding perfectly correct if the tumour had been increasing in size, or causing the patient inconvenience. However, under existing circumstances, I declined to interfere; and as these views were in accordance with the patient's own ideas of the matter, it was agreed that the growth should be left alone unless it either increased in size or caused him pain or inconvenience.

Dr. Grigg sent into the wards, from the out-patient department, an instance of osteo-sarcoma, to which I would draw your attention, in contrast with that of the first case referred to in this Lecture, which illustrated the circumstances of an osteo-sarcoma of more rapid growth. Dr. Grigg's patient had suffered from an osteo-sarcoma, originating from the upper part of her right humerus, for no less than twelve years without experiencing inconvenience beyond that produced by its bulk.

Mr. G. Butler reports, concerning this case, that Jane L., aged fifty-six, first noticed a lump forming on the upper and outer part of "her right shoulder" some twelve years ago. She does not remember receiving any injury to the part. The swelling gradually increased in size, causing the patient no great pain or inconvenience beyond that produced by its bulk.

On admission, I found the patient to be a healthy, active person for her age. A large tumour occupied "the back of her right shoulder, extending half-way down her arm"; its circumference measured twenty-two inches. The tumour was evidently growing from the humerus, forming, in fact, a part of that bone; it felt like a large cartilaginous mass, with here and there spots of softened tissue in its substance; over these red patches the skin was red and tender, but not ulcerated, and the integument covering the remainder of the morbid growth was normal in appearance. There were no enlarged lymphatic glands in the neck; but a canula having been introduced into the tumour, a piece of the morbid growth was removed and presented the characters of a round-celled sarcoma. My advice to the patient was in favour of leaving the tumour alone; it caused no pain, its growth had been a matter of twelve years, and, considering her age, we were not justified in proposing so serious an operation as the removal of the morbid growth together with the right arm.

Although I do not think even rapidly-growing and vascular osteo-sarcomas are usually disseminated by means of the blood to the lungs and other organs, still it is possible that the disease may spread in this way, especially as we know how freely the open venous sinuses of the medulla of bone take up pus and other such materials, forming, in fact, a channel through which organic particles can pass to any part of the body; similarly, portions of a living, though softening, sarcoma may perhaps be carried by the circulating fluid to distant organs. Nevertheless, I have known so many instances, especially of gliomas of the globe of the eye, where nothing of the kind has occurred after the removal of the morbid growth, that I am disposed, with the evidence at present in my possession, to hold to the ideas above inculcated.

It is obvious, therefore, that an osteo-sarcoma, unless it be a rapidly-growing one, may be regarded for surgical purposes as a local disease; but it is nevertheless right to err rather on the safe side in operating for the removal of such tumours. Thus, in osteo-sarcoma of the fore-arm or arm, if you cannot conveniently excise the morbid growth with a portion of the bone from which it grows, amputate in the one case through the elbow, in the other through the shoulder-joint.

And so in the leg, I have excised several large slowly-increasing osteo-sarcomas, with the portion of bone from which they grew, without sacrificing the limb; but if this cannot be effected, should it be necessary to interfere, amputate through the knee-joint. On the other hand, if a tumour of the kind originates in the cancellated tissues of the lower end of the femur, considering the risk to life of amputations through the hip-joint, I should not hesitate to remove the limb above the morbid growth. On the same principle there can be no reason why you should not form your flaps in cases of the kind from the skin covering the tumour, supposing, of course, that the integument is otherwise healthy.

If the origin of osteo-sarcoma is such as I have described, we might expect to meet with instances of the disease among the lower animals; and such, in fact, is the case. Horses, and more especially white ones, are not unfrequently affected with sarcoma. From this fact Heckel argues that white horses originated from a common stock, and hence all are susceptible, through hereditary transmission, to a perverted growth, acquired by one of their ancestors.

We might, if we thought proper, probably accumulate data showing that sarcoma was more frequently met with among fair-haired Europeans than in dark persons. Such is the case in a marked degree with some of the patients whose histories I have to-day brought to your notice; but then, if we turn to other parts of the world, such as India, we discover that people with black skins suffer from these diseases in as large a proportion as Europeans.

CARCINOMA OF BONE.

Many authorities deny the possibility of primary carcinoma of bone, holding that morbid growths of this kind originate from epithelial cells, and as no such cells exist in the medulla of bone they affirm that it is impossible for cancer to originate there. I am not prepared to do battle for or against this idea, but must proceed to consider the subject from a clinical point of view.

The tendency of carcinomatous disease is to be transmitted through hereditary influences. But whatever may be the combination of causes, which develop the formation of cancer, it most certainly spreads from its primary focus by continuity of growth along the lymphatics, and perhaps by mere contact-influence, the living matter passing through the carcinomatous formation receiving an abnormal impression, which it conveys to other living matter. Whichever of these ideas we adopt, the broad fact remains, that the characteristic feature of cancer is its infectious nature, the primary growth not only extending to distant organs but invades and replaces the tissues by which it is surrounded; and every surgeon knows that tumours, having in a marked degree these characteristics, do at times originate in the cancellated tissue of bone, and are composed of an alveolar structure, containing free epithelial-like cells in their alveoli; in fact, they are not to be distinguished microscopically from carcinoma. Of course, it is open to argument that cases of this kind are secondary cancers, that is, that carcinoma has commenced either in the rectum or some other epithelial-bearing structure, and the affection of bone has followed from the primary disease. It may be so; nevertheless, instances of carcinoma of bone have unquestionably occurred in which, on post-mortem examination, as well as during the life of the patient, there was no evidence whatever of cancerous formations which pre-existed independently of the carcinoma of the bone.

I have already referred to a case of malignant disease growing from the dorsum ilii (p. 300). In this instance, the patient died within sixteen months of the date on which I first saw her. The lungs and liver were both infiltrated with carcinomatous growths. The original tumour had replaced the greater part of the ilium, was extremely vascular, and presented the characters of a medullary carcinoma.

I saw another instance of somewhat the same kind with my colleague, Mr. Keen, a short time since. His patient was an elderly lady, who had no history of cancer or other hereditary form of disease. Without any assignable cause, some six months ago, a swelling was noticed beneath her left eye, extending down the cheek; it increased rather rapidly in size, and was attended with sharp cutting pain. The eye-ball was forced upwards and inwards, and when I saw her the skin over the most prominent part of the morbid growth had already become incorporated into the tumour; the parotid gland was enlarged, and the vessels coursing over the tumour engorged with blood. The morbid growth was soft on pressure, and evidently growing from the superior maxillary bone. From the rapid growth, pain, enlargement of the neighbouring glands, and the implication of the skin with the tumour, together with the sallow anæmic look of the patient, we arrived at the conclusion that the tumour was of a carcinomatous nature.

The cancerous cachexia, however, is frequently not developed until a much later stage of the malady than it was in this particular case; it often happens that, in the earlier periods of cancerous affections, the patient's general appearance is unaltered; but a person suffering from the incipient manifestation of cancer invariably loses weight rapidly. The scales, in fact, in such cases might almost be employed as advantageously as the thermometer is in certain forms of fever; and it is in these early stages of cancer that we so much require all the means at our command to enable us to form an accurate diagnosis. As the malady advances and the cancerous cachexia is thoroughly developed, it is more than probable that the tumour we have to deal with will have unmistakably declared its nature.

For instance, a patient may consult us for an enlargement of the upper end of the tibia, with perhaps a fixed pain in this locality. It appears that the head of the bone is enlarged; in such a case, the first point to be considered is the history of the patient, as by learning all the particulars connected with his previous circumstances, examining the state of his teeth and so on, we may eliminate syphilitic affections of the bone from our consideration. Tuberculous disease is not characterized by enlargement of the bones, and is most frequently found among young people with a scrofulous diathesis. The pain from an abscess, or even from an hydatid cyst in the head of the bone, would be chronic; in its early stages there would be only slight, if any, enlargement of the head of the tibia: and the same remark applies to a slowly-growing sarcoma. So that, in all probability, the case under consideration depends either on a deep-seated abscess, which may be determined by means of the aspirator, or upon a morbid growth of some kind or other originating in the cancellated tissue of the head of the bone; but I should certainly decline giving an opinion as to the nature of the disease until I had watched its progress for a time. If, after two or three months, the disease were still localized, the head of the tibia considerably increased in size, the pain intense, the glands in the groin being enlarged, and that the patient had lost flesh rapidly, I should incline strongly to the opinion that this was a case of carcinomatous disease. This idea would be strengthened if there were a family history pointing to cancer—a history, let me remark, which the most truthful patient and his friends will frequently conceal from you, and which is only arrived at by careful cross-examination.

In an instance such as I have supposed, I should strongly advise patience, and no expression of opinion unless it could be given with the strength of a confirmed idea on the subject. My reasoning on the matter would be somewhat as follows:—

This tumour is either a carcinoma or a rapidly-growing osteo-sarcoma; if the latter, and the lymphatic glands are involved, the prognosis must be as bad as if it were a carcinoma. But supposing the lymphatics of the groin were not enlarged—a complication less likely to occur in a rapidly-growing osteo-sarcoma of the tibia than of the femur, but which would exist to a certainty if the disease were carcinomatous—then, in my opinion, we should remove the limb above the knee-joint.

Supposing, however, the tumour continued to grow rapidly, and the surrounding tissues being involved together with the lymphatics, that the cancerous cachexia was marked, and other symptoms pointing to carcinomatous disease manifested themselves, we should, I believe, have done no harm in postponing our opinion as to the nature of the affection, because when we make up our mind that it is a cancerous tumour *of one of the bones of the leg or the femur* we have to deal with, it will be right to explain the nature of the malady to the patient, and in my opinion to affirm our inability to stay its progress, for an amputation of the leg should not be undertaken in a case of this kind. I would simply ask the question, has amputation of the thigh for carcinomatous disease of the leg prevented the disease from springing up in another part of the body within a very short time of the operation? But it may be argued, life is prolonged by means of an amputation. I hardly think so, if we take the aggregate of cases of the kind operated on. What I mean is, if the entire number of days patients have lived after amputation for carcinomatous disease of the bones of the leg and thigh were added together, the total number would amount to a smaller sum than if the patients had not been operated on. It is often said you cannot leave a patient and tell him it is impossible to do anything more for him; give him, at any rate, the hope of life if he is willing to undergo the risk of an amputation. I demur to this line of argument—it is unscientific to propose an operation on grounds of this kind, and having come to the conclusion that the case is a hopeless one, I feel that it is not only right, but the kindest thing we can do, to lay the facts plainly before the patient; those whom we frequently suppose to be timid, under these circumstances evince the greatest fortitude. In truth, human beings are so constituted, that they can almost always face the inevitable with fortitude; it is more satisfactory for them to be able to rest on a certainty, however terrible that may be, than to exist in a state of doubt as to what may be in store for them. You will constantly be urged by over-kind relatives and friends to conceal the truth regarding the absolutely fatal nature of the disease from your patient, and, of course, your own feelings, no less than your inclination, would prevent you from forcing the subject; but when asked by the patient as to the nature of his disease, never consent, either in cases of this kind or under any circumstances, to tell him what is not strictly true, especially when you have to deal with a disease such as the one we have been considering. We have as yet discovered no cure for cancer. In my opinion we have no right to subject a patient suffering from a form of it, such as I have referred to, to an operation; and if this principle were confirmed, it might possibly be the means of leading surgeons to consider more attentively other means of treatment for the relief of this fearful disease.

You will clearly understand that these remarks apply to cases of carcinomatous disease affecting the bones of the leg, for, as I shall have to explain to you on another occasion, in the early stages of carcinoma of the breast we do not hesitate to excise the tumour, together with the skin covering it, and the whole of the surrounding tissues, including the lymphatics in the axilla. In this way we may hope to prevent the recurrence of the disease in the locality from which it has been removed, without, at any rate, endangering the patient's life by means of the operation. Excision of carcinomatous growths in their early stages is, in fact, a perfectly legitimate practice if the disease commences in the glandular structures, and we might very probably be inclined to amputate the arm for carcinoma affecting the bones of the fore-arm, or even the lower end of the humerus; but we cannot overlook the fact that the prognosis in cases of cancerous disease originating in the osseous tissues (and I maintain that veritable primary cancer of the bone does occur) is always an extremely bad one.

With reference to the growth of secondary cancer in bone, or the infiltration of the medulla with cancer-cells, the result of disease in other localities, there can be no question as to the frequency of this occurrence; for instance, we see epithelioma of the face propagated to the jaw-bones, or an epithelioma of the leg to the tibia, setting up a kind of cancerous caries in these bones. What happens is this: cylinders of epithelial-cells are protruded from the primary growth into the vascular pores of the bone, and then they spread and grow. You have seen cases, from time to time, in which the medulla of many of the bones forming the skeleton has become infiltrated with cancer-cells, and so the integrity of the hard osseous tissue has become soft, yielding to muscular pressure or the weight of the body; the affected bone has become bent and misshapen, as I described to you in speaking of mollities-ossium (p. 216); but this condition in cases of cancer is always the result, or, at any rate, apparently follows the development, of carcinomatous disease in other parts of the body, and produces the tendency to fracture of the bones, sometimes met with in persons suffering from cancerous disease.

It is true, in instances of epitheliomas growing from the antrum of Highmore, that as the tumour has increased in size it has destroyed the walls of the cavity from which it originally sprang, ultimately involving the whole of one side of the face; these, however, are clearly not instances of epitheliomas growing from the osseous tissues, but from the epithelial elements, contained within the antrum; for instance:—

J. R., aged fifty-one, a month before admission into the hospital, complained of obstruction in his right nostril. In the course of two months a swelling was noticed bulging down the hard palate on the right side. The skin of the patient's face on the same side became œdematous, and his cheek was forced outwards by a soft elastic growth beneath it; the tumour increased rapidly, invading the orbit and the mouth; the lymphatic glands of the neck were enlarged, and, within four and a half months of the commencement of the growth, the patient died of pneumonia. On examination, it was found that the greater part of the space formerly occupied by the superior maxilla of the right side, was filled with a soft vascular tumour, which extended into the orbit, along the upper border of the palate, and back into the pharynx; the bone had almost all disappeared, with the exception of its alveolar border, sections through which showed a number of processes of epithelium extending from the tumour into the osseous tissue.

The bulk of the tumour was composed of a fibrous stroma, in which numerous nests and cylindrical processes of epithelial cells were visible.

There can be no question that in this case the tumour had originated in the lining membrane of the antrum. When I first saw the patient, considering the rapidity with which the tumour had increased, it was not justifiable to remove the superior maxilla, because it was improbable we should have been able to take away the entire growth, without which an operation of the kind was not to be entertained.

LECTURE XIII.

DISEASES OF JOINTS:—SYNOVITIS AND GRANULAR DISEASE OF THE SYNOVIAL MEMBRANE (SCROFULOUS SYNOVITIS, TUMOR ALBUS).

WE may now conveniently enter upon the study of "diseases of the joints," and it will simplify the subject if, in the first place, I give a general outline of those affections of the synovial membrane which are most frequently met with in practice.

Diseases of the synovial membrane may commence in the loose cellular tissue which surrounds a joint (periarthritis). Affections of this description are by no means of uncommon occurrence, as Dr. V. P. Gibney has recently shown in a paper published in the "New York Medical Journal." When lecturing on acute epiphysitis and also on tuberculous disease of the bones, I had occasion to refer to abnormal changes produced in the neighbourhood of joints by these maladies. At present, however, I propose directing your attention, in the first place, to those diseases of the joint which originate in the synovial membrane, classifying synovitis under three heads, the serous, muco-purulent and purulent. But you must distinctly understand that a division of this kind is employed principally for teaching purposes. In practice we constantly find these three forms of synovitis passing one into the other; in fact, a collection of pus within a joint must have been preceded by a serous and muco-purulent stage of inflammation.

Granular disease of the synovial membrane, or pulpy degeneration of a joint, as it is frequently called, depends on the formation of granular bodies in the synovial tissue and structures external to it; a latent predisposition (scrofulous), or an inherited tendency to this form of disease, is frequently called into activity by means of deranged nutritive changes consequent on inflammation of the synovial membrane, and so it is not uncommon to meet with instances of pulpy degeneration of a joint following synovitis induced perhaps by an attack of rheumatism, an injury, or septic poisoning.

Excluding cases of synovitis resulting from a punctured wound—an accident fortunately of comparatively rare occurrence—we seldom meet with instances of serous inflammation of the synovial membrane among children in our surgical wards, the greater number of cases of this form of synovitis falling to the lot of the physician to treat, being developed during an attack of acute rheumatism, and in exceptional cases only assuming a muco-purulent or purulent form. But we are rarely without adult patients suffering from serous synovitis consequent either on an injury, or else from chronic septic influences: a few cases arise as a result of syphilis. The joint most frequently affected is the knee, so that, for purposes of clinical instruction, I shall illustrate my remarks principally by cases of synovitis of the knee-joint, but the ankle, wrist, elbow, or any other joint of the body may suffer from the various forms, or degrees, of inflammation I am about to describe.

Serous Synovitis.

R. L., aged forty-two, injured his right knee by a fall from a ladder. The accident was followed by pain and swelling of the joint, which has continued up to the present time, and obliged him to enter the hospital. On admission his right knee was very swollen and painful, the skin over the joint being of its natural colour; the pain was aggravated by pressure or any attempt to move the joint, but the patient lay with his leg stretched out in bed, and had no fever. The swelling extended upwards beneath the tendon of the quadriceps muscle, and was evident on either side of the patella where distinct fluctuation could be felt. There was no history of rheumatism, and the only joint implicated was the one that had been injured. With Dr. Dupré's surface thermometer we found that the temperature of the skin over the inflamed knee was constantly three degrees higher than the corresponding joint of the other limb. An elastic bandage was applied round the swollen joint, and a splint applied extending from the thigh beyond the foot so as to prevent the patient from moving his knee or standing on the right leg; under this treatment the synovitis rapidly diminished, and at the end of a fortnight he left the hospital cured.

With reference to the use of the *elastic bandages* I refer to those recommended by Dr. Martin, made of india-rubber or some such soft elastic material. When first applied in cases of synovitis they may cause some amount of pain, but this usually passes off in the course of an hour or two. I not unfrequently smear the skin of the inflamed joint over with an ointment composed of equal parts of extract of belladonna and vaseline, outside this a layer of cotton wool is placed, and the whole is surrounded by the elastic bandage, applied with as much force as the patient can bear without causing him great pain; when using these elastic bandages the limb must first be surrounded from its extremity upwards with a linen roller, otherwise the pressure of the elastic bandage will naturally cause the patient's foot and leg to swell.

The above case is a fair example of the course which the majority of instances of serous synovitis run if caused by an injury such as I have described, supposing they are carefully treated from the first, but everything depends on the early and efficient application of curative measures at the commencement of the disease, for, if permitted to continue, the synovitis may become aggravated into a mucopurulent form, or it may pass into a chronic condition; leading, perhaps, to the complete destruction of the joint or to the growth of bands of connective tissue in the soft structures external to the joint, which, as they become organized, limit the movements of the articulation.

Serous synovitis, however, is often accompanied with more severe symptoms than those above described. For instance, a man in jumping from a cab sprains his knee; the joint in the course of a few hours becomes very painful and swollen. The injured knee feels hot to the hand, is red and inflamed, the soft tissues round the joint are œdematous, the leg also is much swollen, fluctuation can be felt in the joint, its temperature being persistently two or three degrees higher than that of the sound limb. The patient lies in bed, with the knee flexed; the thigh is rotated outwards and abducted; he resists every attempt to move the leg, as it causes him great pain.

Under these circumstances leeches should be applied to the skin over the joint, and subsequently ice, or if that is not to be had the arnica or acetate of lead lotion with belladonna; a splint should, as a rule, be applied, and the patient must be kept in bed or on a couch. It is well, in the first instance, to explain to him that rest of this kind, enforced for a week or a fortnight, will, in all probability, be necessary for his recovery. If the patient has a tendency to rheumatism or gout, we must, in addition to the local treatment, employ such further means as we consider best adapted to overcome the effects of the constitutional malady from which the patient suffers. The difficulty in these cases is to induce our patients to undergo the necessary restraint, without which it is impossible to ensure their recovery. Whether the injury has occurred to the knee, wrist, or any other joint, no sooner does the pain subside than the patient usually insists on moving the limb, and so he frequently keeps up the hyperæmia and synovitis, and thus the articulation grows stiff with constantly recurring periods of pain after exertion, due to the stretching of the thickened tissues which have formed around the joint during the acute stage of the disease.

The contents of a joint affected by synovitis, such as I have described, if drawn off by an aspirator will be found to consist of translucent albuminoid fluid more limpid than the naturally viscid secretion of the part. The surface of the synovial membrane, if examined in the recent state, is vascular, much resembling in appearance the conjunctiva when affected by catarrhal (serous) inflammation.

The point, however, which I would insist on is, that in a very large majority of cases of traumatic synovitis, treated by rest, a few leeches, cold applications, aconite, and perhaps counter-irritation subsequently, the disease will not pass beyond the stage of serous effusion; but, so long as the joint is painful, rest must be enforced, a splint in all cases being, if possible, applied, and counter-irritation in the form of the linimentum iodi used over the skin after the more acute symptoms have subsided; we frequently meet with instances demonstrating the ill effects of neglecting this practice.

MUCO-PURULENT SYNOVITIS.

S. H., aged twenty, was admitted into the hospital on December 3rd; the patient was a strong, healthy girl; she had never suffered from rheumatism; there was no family history pointing to hereditary disease of any kind. About a month since S. H. fell and injured her right knee; the joint became excessively painful during the night after the accident and throughout the following day; subsequently she was compelled, from the nature of her employment, to move about; she was, however, seldom free from pain. Tincture of iodine was applied to the skin over the joint, but the patient was unable to rest her leg until she came into hospital. On admission we found the knee distended with fluid, the temperature of the joint constantly from three to five degrees higher than that of the other limb. The patient was kept awake at night by involuntary starting of the leg, producing the most violent pain; her suffering was aggravated by pressure made over the joint. No other articulation of her body was affected. I drew off the contents of the distended synovial membrane by means of an aspirator; it consisted of a turbid straw-coloured muco-purulent fluid.

Immediately after this fluid had been removed we applied a layer of extract of belladonna over the skin of the joint, and outside this cotton wool which was surrounded with an elastic bandage, bound round with force sufficient to keep up considerable pressure on the part. The limb was then fixed to a splint. After about fourteen days of this treatment counter-irritation by means of the linimentum iodi was substituted for belladonna, and in the course of three weeks the patient was able to move about the wards; she ultimately left the hospital perfectly cured.

As I have already remarked, it is impossible to draw a hard and fast line between cases of serous and muco-purulent synovitis, but as a rule we may affirm that in an inflamed joint a persistent rise of temperature of three to six degrees above that of the corresponding healthy joint is an indication that muco-purulent inflammation exists in the synovial sac; but it is only in articulations such as the knee and elbow, which are not enclosed by large muscles, that we are able fully to appreciate a local rise of temperature of this kind.

The inference we draw from a persistent local increase of temperature is, that the alteration in the nutrition of the serous membrane necessary for the formation of muco-purulent matter is more likely to lead to new growths around the part, or to end in a condition of chronic synovitis, than in the serous form of the disease; hence the necessity for greater caution and patience in the treatment of the more severe cases. Moreover, if a synovitis accompanied by a persistent and marked rise of temperature, or in other words a muco-purulent or purulent inflammation, be allowed to run its course, it is not improbable that the abnormal action may so far affect the nutrition of the articular cartilage, ligaments, or bones as to lead to degeneration and perhaps necrosis of these parts and destruction of the articulation.

As an instance in point, F. S., aged twenty-five, was transferred from the medical to the surgical wards on March 5th; she had suffered from acute rheumatism with intense pain in her left knee; the other joints of her body soon recovered their functions, but her left knee continued swollen and painful. She has been in the medical wards for a month, and has taken alkalies, iodide of potassium, and so on; the knee-joint has been freely blistered. On coming under my care the temperature of the left knee was for some days constantly three and a half degrees higher than the corresponding joint of the other leg; the patient was always in severe pain; she complained much of the limb starting at night; the joint was greatly swollen, but the skin covering it was neither red nor inflamed. She was feverish, and much depressed in spirits. I drew off the contents of the inflamed joint by means of an aspirator, and then applied belladonna and pressure as in the last-mentioned case; the limb was semi-flexed and kept absolutely at rest. On examining the fluid from the synovial sac it was found to be straw-coloured and muco-purulent, a condition by no means unfrequently met with among persons of all ages and grades in life who have suffered from a long-continued attack of sub-acute rheumatism.

Our patient was relieved by the operation for a time, but the fluid very soon re-accumulated in the joint, and I emptied it on several occasions by means of an aspirator: the actual cautery was used and various other means of treatment employed, but no improvement took place; and, after an interval of some weeks, it became evident more decisive measures were necessary. I had the patient placed under the influence of ether, and found crepitation between the femur and tibia: the joint was therefore laid open on either side of the patella, and a probe having been passed into one of these incisions, its extremity was pushed through the articulation and made to protrude the skin in the popliteal space; the integument was incised, and tubes passed through the joint from before backwards, and another from side to side, thus procuring free drainage through the popliteal space.

I then divided and broke through adhesions which had formed in and around the articulation so as to relieve the joint from tension. A splint with an arched iron rod over the knee was applied along the anterior surface of the thigh and leg, not to interfere with drainage from the wound in the popliteal space.

Antiseptic dressings were not employed in this case, because I was anxious to save the patient the pain and inconvenience attending their use, and we did not run much risk of absorption of putrid material either through the ends of the bones entering into the formation of the knee-joint or the surrounding tissues, the inflammatory process existing in the locality for so long having in all probability produced some sclerosis of the ends of bones and induration of the soft tissues around the joint to an extent sufficient to protect the system from septic poisoning; the free and dependent opening from the knee was also intended to prevent putrefying materials collecting in the part.

I need not trouble you with details as to the subsequent treatment of this case; the wound was kept scrupulously clean, and the patient gradually recovered; after four months interval she was able to perform her duties as a maid-of-all-work, although she has anchylosis of the knee-joint.

I would here observe that this is an exceptional case. I by no means advise you to cut into a joint, although its condition is such as I have described, unless you are convinced that the patient's health is failing under the effects of the disease. A temperature chart should be carefully kept, and the condition of the pulse and the digestive organs noted, especially the latter, for so long as a person can take food and assimilate it, recovery is almost always possible, and our patients, no less than those whose duty it is to attend them, are often rewarded through the exercise of that indispensable virtue, patience. In no class of cases is this principle more needed than in instances of diseases of the bones and joints. Sometimes counter-irritation, especially the actual cautery, aided by rest, Scott's dressings with well-applied pressure, will hasten the recovery, and as the acute symptoms pass off and the wounds heal, the plaster of Paris bandage is invaluable, enabling a patient to be removed from bed without trouble, and, weather permitting, to be taken into the open air or from one room to the other. In not a few cases, if the fluid from the joint is drawn off by means of an aspirator, and Scott's ointment is then employed together with an elastic bandage, the patient will rapidly improve. Subsequently, by counter-irritation and rest, the functions of the articulation may ultimately be restored.

On examining the interior of a joint affected with muco-purulent synovitis, we find it is intensely congested and swollen, especially the tufted processes at the sides of the joint. The surface of the serous membrane is often covered with a fibrous formation like that seen in inflammation of the pleura and composed of a fibro-cellular structure. The articular cartilages on their free surface will have assumed a fibrous structure, and in many places softened patches, if not cavities, will be detected in them; this condition of the cartilages is due not only to altered action going on in the synovial membrane, but also to changes effected in the circulation of the blood passing through the cancellated tissues of the end of the bone produced by the inflamed condition of the tissues surrounding the joint. We must constantly bear the fact in mind that in synovitis it is not only the interior but also the structures exterior to the serous membrane which become inflamed.

If the articular cartilage and the sub-cartilaginous layers of bone are destroyed by inflammation before sclerosis has occurred to seal the ends of the cancellated tissue, the medulla sprouts from the extremities of the contiguous bones, ossification occurs in it, and so firm union may take place between contiguous bones precisely as in a case of fracture. I have specimens here which demonstrate the fact that bones united in this way grow together so completely that it is impossible to make out from sections through them either their line of union or the position of the joint which formerly intervened between them.

SEPTIC MUCO-PURULENT SYNOVITIS.

In a previous Lecture I described the symptoms and post-mortem appearances met with in cases of septicæmia and pyæmia, so that I will not revert to the subject, but merely remark that the veins of the genito-urinary passages when injured "cannot easily unite for physiological reasons." This fact is borne out by practical experience, for we find that there are few parts of the body (excepting perhaps the medulla of bone) from which septicæmia and pyæmia more frequently take their origin than in injuries and diseases of the organs referred to, the veins in these structures evidently affording a ready ingress to septic matter into the system, especially among males; in the case of females there is less chance of dead or dying organic matter being retained in the sub-mucous tissues of the genito-urinary organs, for the discharges can more readily pass away; but there are exceptions to this rule (see Appendix B.)

I need hardly observe that it is no uncommon circumstance to meet with urethral fever following the introduction of a metallic catheter. I do not refer to those cases in which constitutional disturbance occurs immediately after the passage of an instrument, and which in all probability depend upon nerve influences. But you will see instances of fever in the course of your career supervening on the passage of a catheter, or on forcible dilatation of a stricture, occurring in from eight to twenty-four hours after the operation, attended with the formation of clots in the right side of the heart, and in less serious cases with loss of muscular power of the heart and respiratory muscles, producing very alarming symptoms. In cases of this kind I have seen, after death, the epithelial cells of the kidney and alimentary canal detached in considerable quantities from the basement membrane, with extensive patches of local congestion and ecchymosis of the lining membrane of the heart, and of the serous and mucous membranes, pointing to death from septicæmia.

Fortunately for our patients these severe cases are of comparatively rare occurrence; but urethral fever in a milder form, that is less dangerous attacks of septicæmia following traumatic injuries of the urethra, are by no means rare.

In the same way after lithotomy not a few deaths occur, especially in unhealthy localities, from septo-pyæmia, and, what is very remarkable, in almost all such cases suppuration occurs in the joints. This fact has been noticed by many observers, and I cannot remember seeing a case of septo-pyæmia after lithotomy in which purulent matter has not been found in some of the larger articulations. It is not very easy to account for this, but it prepares us for the fact that in septicæmia, connected with putrid matter formed along the course of the genito-urinary tract, we find that the septic matter exercises its chief influence upon the joints, producing serous or muco-purulent synovitis.

A patient contracts gonorrhœa, and it may be in the acute stages of the disease, or perhaps later in its course, he is seized with symptoms of inflammation of the synovial membranes of one or more joints; the attack is very severe, and in the course of a few days there is a persistent rise in the temperature of the affected part as compared with that of the sound limb, as well as general fever. If the contents of the synovial membrane be then drawn off by means of an aspirator, it will frequently be found to consist of a muco-purulent fluid; in fact, gonorrhœal synovitis is essentially a modified form of septic poisoning (p. 25).

The pain in the joint is most severe, and the parts outside the inflamed serous membrane are swollen and œdematous, so that the joint is more uniformly enlarged than in cases in which the synovial membrane is simply distended with fluid. The skin over the diseased joint frequently retains its normal colour. One joint after another becomes affected; the patient's health suffers not only from the pain but from the blood-poisoning under which he labours. So long as the discharge from the urethra lasts the synovitis continues, and leads to induration of the tissues around the affected articulation.

In cases of gonorrhœal synovitis, therefore, we must direct our efforts in the first place to the relief of the mischief going on in the urethra, and to the improvement of the patient's general health, which, over and above the disease of the joint, is always seriously compromised in these cases, and will often remain impaired long after the symptoms of synovitis have passed away.

With regard to the synovitis: if for several days the temperature of the diseased part is from three to four degrees higher than that of the corresponding healthy joint, and if the synovial membrane is much distended with fluid, it is advisable to empty the articulation by means of an aspirator; but, remember, much of the swelling in these cases is due to œdema of the soft tissues external to the synovial membrane, and the quantity of fluid in the joint may be very small. Whether the joint is punctured or not, it should be covered with the extract of belladonna, outside which layers of cotton wool must be applied, and the whole tightly bound round with an elastic bandage; the limb may then be secured on a splint, so as to keep the parts perfectly at rest. In this way you may treat one inflamed joint after another, and I know of no other treatment which, under the circumstances, so effectually subdues the diseased action going on in the joint: but I am convinced that, with patience, the application of belladonna, fomentations, pressure, and a splint, many severe cases of gonorrhœal synovitis will recover without puncturing the synovial membrane.

I would therefore advise (especially in private practice) that the patient should first be carefully treated for some days in the manner I have described; if, however, the symptoms do not yield, there can be no question as to the advisability of drawing off the fluid in the synovial membrane by means of an aspirator; for the contents of the inflamed joint act as a further source of septic poisoning, and so the disease continues. The acute symptoms having subsided, counter-irritation should be employed in the form of iodine paint, or the actual cautery; the joint may perfectly recover its functions.

It seems reasonable, with evidence such as that to which I have referred, connecting muco-purulent synovitis with purulent discharge from the urethra, that we should meet with a similar condition arising from other sources of chronic septic poisoning, such, for instance, as caries of the alveolar sockets of the upper and lower jaw, infective matter being absorbed into the circulation through the open cancellated tissue of the bone. Chronic discharges from the vagina, affections of the uterus, and so on, come under this head; a fact noticed many years ago by Dr. Todd, who observes that, "It is remarkable how frequently chronic rheumatism of the joints occurs in women, and how rarely in men; and there are many facts which indicate that, in the former, it may have an uterine origin, either connected with the puerperal state, or from a defective or difficult catamenial action." Dr. Todd was inclined to believe that "the unhealthy secretions of the uterus afford material for the production of rheumatic matter," and he quotes Sir Henry Holland, Sir Charles Locock, and Dr. Rigby as authorities in favour of the opinion that there is some connection between the sexual functions and the causes and course of gout and rheumatism. The idea of a morbific matter absorbed into the blood ran through all these opinions and Dr. Todd's well-known theory as to the causation of acute rheumatism by uterine disorders and pregnancy.

It is true some authorities hold that gonorrhœal synovitis is largely due to an arthritic diathesis, or perhaps to a rheumatic gouty tendency, which is said to be the primary cause of these joint-complications. If such were the case, it is difficult to account for instances of gonorrhœal rheumatism which we frequently meet with among the natives of India, who are almost absolutely free from rheumatic gout; moreover, the injection of purulent matter into the cellular tissue of certain animals not unfrequently leads to inflammation of the synovial membranes—a fact which may, perhaps, best be explained by supposing that the purulent matter passes from the blood into the synovial membrane, and being retained there excites a similar action in the surrounding structures to that which it is itself undergoing. However this may be, I am not disposed to place too much importance on the influence of an arthritic diathesis in the causation of that form of synovitis known as gonorrhœal rheumatism. Indeed, among Englishmen it would be difficult to find a family absolutely free from gout or rheumatism, so that all cases of synovitis might be traced back either to gout or rheumatism, if we have determined beforehand that this diathesis is the cause of these joint-affections.

In conclusion, I must reiterate the observation already so frequently made that in instances of synovitis accompanied with a discharge of purulent matter connected with the genito-urinary organs or from the medullary tissue of bone, the first thing we have to do in connection with the treatment of the synovitis is to remove, if possible, the source from which the infective matter enters the system.

Suppurative Synovitis.

Admitting that gonorrhœa and other sources of purulent discharge are capable of producing septo-pyæmia, such as that to which I have referred, it is nevertheless true that the virulence of the symptoms induced by infective matter of this kind not only varies with the source from which it arises, but also with the circumstances under which the patient lives; unhygienic conditions evidently increasing the active power which poisonous matter of this description exercises upon the system.

Thus, as I have before remarked, after operations such as that of lithotomy, we not unfrequently find, in malarious countries, rapid and fatal pyæmia attacking the various joints of the body a few days after the operation. Joints opened when they are diseased in this way present very much the appearance of the conjunctiva affected with purulent conjunctivitis; the soft parts surrounding the joint are infiltrated with pus, and the calcareous laminæ enclosing the ends of the bones are denuded of cartilage; in fact, ligaments, synovial membrane, and the entire structures entering into the formation of the inflamed joint, are speedily destroyed. The same condition is found in the worst cases of puerperal fever. There is little to be said regarding the treatment of these virulent cases of pyæmia; in spite of anything we can do, so far as my experience goes, patients suffering in this way invariably die.

Purulent synovitis, however, may originate from other causes besides that of septic poisoning. For unless a joint which has been opened by accident—as, for instance, by a punctured wound—is at once carefully cleansed from all extraneous substances, and then kept at rest and scrupulously clean, the blood from the divided vessels, as well as the secretion from the synovial membrane being retained in the articulation (at a temperature of probably not less than 98°), into which air freely passes, putrefaction occurs in this organic matter, and is likely to set up a similar action in the surrounding parts, so that the joint is speedily destroyed. This process, however, is one that takes from three days to a week to accomplish: in the meantime the protoplasm in the neighbourhood of the injured joint has thrown off elements which, becoming organized, may constitute a barrier against the direct absorption of putrid matters collected in the joint from entering the circulation, so that fatal pyæmia is perhaps thus warded off; nevertheless, we know from experience how high the fever runs in cases of this kind, and that not a few lives and limbs have been lost from punctured wounds of the larger joints.

The secret of success in treating cases of this description is in recognizing the fact that the fever and other general symptoms from which the patient suffers depend upon the absorption into the system of infective matter derived from the diseased joint. Admitting this principle, it is evident that our endeavours must first be directed to preventing putrefying substances from being retained in the articulation. In civil practice this may generally be effected by means of free drainage and carefully and constantly washing away all the discharges that occur in and about the joint, or still better, by preventing putrefaction from taking place in the part by means of the Listerian system of dressing. At the same time the injured joint must be kept at perfect rest. It is often necessary, in case of a wounded joint, to open the articulation freely, unless the injury is of very recent date, under which circumstances, suppuration not having already occurred in the part, the joint should be carefully and thoroughly washed out with a solution of carbolic acid, one part in eighty, the carbolic spray being used at the same time; efficient drainage should be employed under antiseptic dressings—the limb being fixed to a splint. We may thus not only check inflammation, but also, if the case progresses favourably, hope to restore the natural movements of the articulation.

If suppuration has taken place, after a joint has been opened by a small wound, it should be freely incised and unexceptionable drainage employed; for instance, if the knee be the part implicated, free incisions should be made at either side of the joint and a drainage tube passed in this direction; a probe should be inserted into one of these incisions and thrust through the joint, its extremity having been made to distend the skin in the popliteal space the integument should be divided over it, and another drainage tube passed from before backwards through the joint. In a case of this kind I divided the tendons of the ham-string muscles with advantage; the success of the case greatly depends on relieving tension in the joint. A splint must be applied to the anterior surface of the thigh and leg, the two being connected with an iron bridge passing over the knee; in this way the limb can be kept absolutely at rest, there will be no obstruction to the flow of matter from the joint through the dependent opening in the popliteal space, and the parts may be constantly and freely syringed out with the ordinary red lotion, so that no putrid matter can collect in the articulation; we may thus fairly hope ultimately to obtain bony union, or anchylosis of the joint.

The length of time necessary to keep drainage tubes in the joint, under circumstances such as I have referred to, must depend on the condition of the parts; but there can be no necessity for retaining the tube passed from side to side into the joint for more than ten days, the drainage through the popliteal space being retained for perhaps a week longer. Our object is to allow the wounds on either side of the joint to heal, and we can then apply a plaster of Paris bandage round the limb and over the articulation, leaving an opening behind the joint so that matter can easily pass away—the red lotion being syringed through the wound two or three times a day. Dressings of this kind will enable the patient to be moved from his bed, and, weather permitting, to be taken out into the open air—a proceeding which will in no small measure expedite his recovery.

Muco-purulent and purulent synovitis may, however, be the result of disease commencing in the cancellated tissue of one or more bones entering into the formation of a joint. We are frequently consulted regarding cases of diseased joints supervening, it may be, on rheumatism; the acute symptoms having passed away, the joint remains extremely painful and swollen, and the symptoms are not alleviated by counter irritation, rest, compression, and other treatment; the slightest exercise or even movement of the limb increases the pain in the part. The surrounding muscles are often rigid, and there is starting of the limb at night; indistinct fluctuation can be felt in the articulation through the indurated subcutaneous tissues surrounding it.

The question arises as to the nature of the disease. Is it a case simply of synovitis? or, in addition, are the bones and other structures entering into the articulation compromised?

Supposing that there are no abscesses or sinuses leading into the joint, or crepitation on moving the articulation to be detected, we should consider the age and family history of the patient. If an adult, free from suspicion of syphilis, or of any source of chronic septic poisoning, I should be disposed to consider the case as being probably due to muco-purulent synovitis followed by pulpy degeneration of the synovial membrane. A thermometer would indicate by the local temperature the intensity of action going on in the inflamed part, and (if in an adult) the aspirator would settle the question as to the nature of the effusion, or how far the swelling depended on indurated or a thickened condition of the structures external to the synovial membrane.

It is, of course, quite possible in non-traumatic cases of this kind occurring in an adult that the cancellated structure in the extremities of the bone may be diseased, without evidence of enlargement of the bone, and that the articular cartilages have been destroyed; but even then crepitation may not be felt if the ends of the bones are covered with granulation tissue; in such a case, if sinuses existed, by means of a probe we might, very possibly, detect the presence of dead bone. The amount of lateral movement in a knee-joint is a very fair indication of the extent to which the ligaments and other structures are affected; when these are destroyed the tibia can be almost freely moved from side to side on the femur, a condition commonly met with in the advanced stages of all forms of extensive disease of the knee-joint before bony anchylosis has taken place.

On the other hand, supposing we were consulted in a case such as I have referred to, the patient being a child, the disease of the joint, if not depending upon, is probably the outcome of tubercular inflammation of the bone entering into the formation of the articulation; but if you were to ask in any given case, either in a child or an adult patient, during the earlier stages of the joint-affection if the bones were or were not diseased, in not a few cases it would be difficult to give a definite answer, because there are no positive symptoms by which disease, such as I have referred to, can always be diagnosed from those cases of synovitis which occur independently of bone-complications. The same difficulty in diagnosis occurs among children suffering from synovitis consequent on an injury; it is true, in a case of this kind that inflammation of the synovial membrane usually supervenes almost immediately after an accident, and so at the onset the disease is perhaps simply synovitis, but its continuance may very possibly depend on lesions affecting the growing bone which occurred at the time of the injury done to the joint, and which has led to slowly progressing mischief in the part.

STIFF JOINTS CAUSED BY SYNOVITIS.

I have frequently referred to the fact that synovitis is not simply an inflammatory action extending inwards—that is, to the cavity of the joint from the synovial membrane—but that the soft tissues external to this membrane also become inflamed; one of the results of this increased action is the abnormal growth of the connective tissue in the affected parts, and as the inflammation subsides bands of thickened connective tissue form within, but principally outside the inflamed articulation. These bands adhere to contiguous bones, and as they become organized they contract, and bind the bones to which they are attached to one another, and also to the synovial membrane, and so they impede the free movements of the joint. Under these circumstances every time a patient attempts to extend the affected limb these fibrous bands are put on the stretch to such an extent as to cause considerable pain; this keeps up irritation in the part, recurrent synovitis is established in the neighbouring joint, leading to an increase of the fibrous bands, and so the functions of the joint is greatly impaired.

In cases of iritis we have frequently watched the effects produced by neoplastic formations which, becoming organized, bind the iris down to the capsule of the lens, when synechiæ, or bands of adhesion of this kind have formed, whenever that portion of the iris which is free dilates and contracts, it drags on those parts of the iris, which are bound down to the lens. This traction keeps up irritation, and produces recurrent iritis, which, in its turn, causes the formation of more synechiæ, and ultimately to the loss of the affected eye; but if in the early stages of iritis we break through the newly-formed adhesions by means of atropine, we may generally arrest further mischief in the eye, at any rate so far as the mechanical difficulties to which I have referred are concerned. And this is very much what happens in severe or long-continued cases of synovitis, the connective tissue external to the inflamed membrane produces neoplastic formations, it may be around the knee, binding the condyles of the femur to the head of the tibia, and whenever the patient attempts to extend his leg he not only experiences mechanical difficulty in doing so, but the effort produces a considerable amount of pain. Under these circumstances patients come to consult us, suffering from joints which are, perhaps, slightly swollen, with their movements more or less impaired and painful, following an attack of synovitis, caused, perhaps, by a sprain or the result of rheumatism, gout, or septic poisoning The question arises, does the stiff, but still movable joint, depend on progressive disease of the bones or other structures entering into its formation, which has induced a rigid condition of the surrounding muscles from reflex nerve-action, or does it arise from the growth of fibrous bands, such as those to which I have above referred?

In the majority of cases there is not much difficulty in answering this question. The presence of sinuses around a joint, enlargement of the ends of the bones, partial dislocation, pain and starting of the limb when the patient is at rest, and especially at night, are symptoms leading us to the conclusion that the various structures entering into the formation of the articulation are more or less diseased, and the tense tendons around the joint point to one cause of its loss of mobility. These are not the class of cases, however, to which I have referred, but rather to those of which the following is an example:—

A patient came limping into my room with the aid of a stick and supported by his servant: four months previously he fell from his horse and injured his left knee. The accident was followed by inflammation of the joint, and from that time he had been unable to put his foot to the ground without considerable pain. On examination, it was found that the right knee was fixed and slightly flexed; there was no synovitis, but the end of the femur appeared to be enlarged, and pressure over the inner condyle produced considerable pain. The tendons of the ham-string muscles were very rigid. The patient having been placed fully under the influence of chloroform, sufficient force was employed to flex the leg completely on the thigh; while this movement was being completed, bands of adhesion were felt to be broken through around the joint, after which flexion and extension of the leg could be made with perfect freedom. At the expiration of a week the patient was able to move about without pain, and subsequently perfectly recovered the use of his leg.

In cases of this kind be cautious in arriving at the conclusion that disease of the bones exists because they appear to be enlarged, a condition not unfrequently more apparent than real, and produced by the wasting of the soft tissues covering the joint in consequence of disease and want of exercise. Actual enlargement of the part may also occur from induration of the tissues surrounding the bone. With regard to localized pain on pressure in cases of this description, this symptom is of common occurrence in almost all forms of disease of the joints, and is seldom absent when the impediment to its movements depends on the formation of fibrous bands external to the articulation.

The following case illustrates this point. H. K., aged eighteen, was admitted into hospital on November 24th; there was no history of tubercular or other hereditary disease, and the patient had been in good health until August last, when he was struck across the right knee. From the time of the accident he suffered from almost constant pain in the joint. On coming into hospital we found the patient's right leg was slightly flexed on his thigh, so that when he attempted to walk his toes only reached the ground, but an effort of the kind caused him so much pain in the knee that it was with difficulty he could move about the wards with the aid of a stick. On examining the joint we found it to be slightly swollen; its temperature was normal. On pressure over the inner part of the head of the tibia the patient complained of great pain, referring most of his suffering to this locality when he attempted to walk or to bend his leg. H. K. was brought fully under the effects of ether, and the leg forcibly and completely flexed on the thigh. While doing this several bands of adhesion were felt to give way with a snap, after which passive motion of the limb to its fullest extent was effected without the slightest resistance, and the patient was subsequently able to walk as well as he had ever done.

In this case the nature of the accident and the condition of the patient on coming into hospital, pointed clearly to the formation of bands of connective tissue between the femur and the tibia; whenever he attempted to walk, or even extend his leg, these constricting bands were stretched to such an extent as to cause a very considerable amount of pain. I have before referred to pain of a localized character as being frequently met with in these cases of stiff joints. This patient was able to put his finger directly over a spot on the inner side of the head of the tibia in which he suffered the greatest amount of pain. When he ventured to extend his leg, or when pressure was made over the spot, the pain was very marked. These symptoms were evidently caused by the attachment of the constricting bands to the head of the tibia, any movement of the limb by stretching these bands caused the patient much pain.

There is a proper hesitation on the part of most surgeons to use force in moving a joint which has become stiff from synovitis, for fear of re-exciting inflammation in the articulation, and thus, perhaps, of producing irreparable mischief in the part. Fears of this kind, however, need not be entertained, if the temperature of the part is normal, and the outlines of the articulation are tolerably well defined, some amount of motion still existing in the joint, and if it be the knee, the patella being still movable, demonstrating the fact that bony anchylosis has not taken place: we may then with confidence forcibly flex the stiff joint until its movements become perfectly free, provided the patient has been placed fully under the influence of anæsthetics. Under these conditions, in the majority of cases, complete flexion of the hip, knee, ankle, or any other joint may be effected without the aid of mechanical appliances, although we meet with adult patients suffering from extensive fibrous adhesions about the joints, especially the hip, which cannot be broken down by the unaided strength of the surgeon. Under these circumstances the operator may, with undoubted advantage, resort to mechanical means to aid him in completely flexing a stiff joint.

Among children it is necessary to exercise greater care in breaking down bands of adhesion which have formed round joints that have heen inflamed, because if too much force is employed, bones may be fractured, or the epiphysis torn away from the diaphysis; this is especially the case in adhesions about the elbow-joint. Among children, in most cases of chronic joint-disease, the idea of tuberculous osteo-myelitis rises before our mind's eye, and not only renders our prognosis somewhat doubtful, but should make us cautious lest by the exercise of force applied to a stiff joint we re-excite inflammation in the bones.

But whether in the cases of adults or of children, there is one point we cannot too strongly insist upon with reference to bands of adhesion which have formed about inflamed joints, and that is to completely break down all the existing adhesions, otherwise we had better not interfere with the case at all; absolute and complete flexion and extension of the affected joint must be insisted upon if we would hope to restore the natural motions of the articulation.

With reference to the division of tendons at the time of forcibly flexing a stiff joint, or previously to undertaking manipulation of this kind, there can be no question that rigid tendons and bands of fascia which exist, after the patient has been fully brought under the influence of anæsthetics, should be divided subcutaneously before complete flexion of the joint is attempted; for tendons which remain rigid under these circumstances have themselves undergone inflammatory changes, which may best be overcome by section. As a rule, it is well to divide tendons of this kind subcutaneously, and allow time for the wound in the skin to heal, before we proceed forcibly to break down the fibrous bands of adhesion about the joint.

Having expressed so positive an opinion regarding the advantages to be derived from a forcible flexion of stiff joints, such as those to which I have referred, it is almost useless for me to remark that I am no advocate for the system of gradual extension of fibrous bands which have formed round inflamed articulations. Treatment of this kind is accompanied with great pain, and in the majority of cases the result is unsatisfactory, for if we succeed in stretching these fibrous bands they are extremely apt to contract again as soon as the force which has been used to extend the limb is removed. This remark applies equally to the treatment of adhesions which have formed about the articulation of the jaws, preventing the patient from freely opening his mouth. Bands of adhesion of this kind may gradually be forced open by means of wedges thrust between the teeth; but how seldom this treatment ultimately succeeds in relieving patients affected in this way. What we require is, to break through all the new growths which have formed around the joints; having accomplished this, the impediments to its natural movements are overcome, and there is an end of the patient's trouble.

In these cases you must not be deterred from flexing a stiff joint because the patient complains of pain in the affected articulation; it not unfrequently happens that the most effective method we can adopt to cure these symptoms is forcibly to flex or extend the limb when the patient is under the effects of ether.

GRANULAR, PULPY, STRUMOUS DISEASE OF THE SYNOVIAL MEMBRANE (TUMOR ALBUS).

By these and not a few other names has the affection we are now to consider been described. In order better to explain the circumstances of granular disease of the joints, I will at once proceed to give the history of a patient from records kept for me by Mr. Glassington:—

W. B., aged eighteen, was admitted into the hospital on January 3rd. He was a well-made, powerful young fellow, and had always lived in the country. His father and mother are healthy people; he has three brothers and two sisters, who are all strong and well. A year ago, without any assignable cause, W. B.'s left knee-joint became painful; the pain only lasted two or three days, but recurred from time to time, especially after exercise; he was therefore ordered to keep to his couch for some time that the limb might have perfect rest. In fact, from the commencement of the affection of the joint from which he now suffers, he has rarely been allowed to put his foot to the ground.

On admission into the hospital, we found that the patient's left knee measured about an inch and a half more in circumference than the corresponding part of his other leg. The skin covering the diseased joint was natural in appearance. The patient could flex and extend the limb and walk without pain. The knee was uniformly swollen, and on comparing it with the sound one, when the leg was extended, the natural furrows on either side of the patella were almost obliterated; the joint felt soft and doughy; no fluctuation could be detected in it. I ordered a linen bandage to be applied round the patient's foot and leg, and then surrounded the knee-joint with an india-rubber bandage, so as to keep up equable pressure over the diseased articulation. As soon as the patient had learnt how to apply these bandages himself, he was directed to wear them constantly and to return to the country. It is upwards of a year and a half since he first commenced this treatment; the swelling and stiffness of the knee-joint gradually disappeared, and it is almost impossible to detect any sign of disease in the part. He is able to walk, and, in fact, to resume his occupation as a farmer.

The following case affords us an opportunity for examining the condition of a joint in which the form of disease we are now considering had advanced somewhat beyond the stage referred to in the above case. D. C. was admitted to this hospital under the care of one of our surgeons on August 23rd, suffering from "pulpy degeneration" of the right knee. By occupation he was a farm labourer, residing near Richmond; he had enjoyed good health up to the commencement of his present illness. His mother died of disease of the lungs; his father, two brothers, and sister are living, and appear to be strong and well. Some four years before this man was admitted into hospital he began to complain of pain in the right knee, which gradually became swollen; the pain was not so great as to prevent his continuing his work; none of the other joints of his body were affected, and his general health remained unimpaired.

On admission into the hospital the circumference of the right knee was nearly four inches more than that of the left. The leg was extended on the thigh, and there was no tendency for it to assume the flexed position. The skin covering the articulation was of its natural colour; the joint was uniformly swollen, and felt soft and doughy; no fluctuation could be detected. An abscess subsequently formed in front of the thigh about an inch and a half above the upper border of the patella. Another fistulous opening existed near the inner surface of the head of the tibia. These sinuses discharged freely, and others formed on the outer part of the joint. The patient was now in constant pain, had more or less fever, and his general health began to suffer. After two months' treatment without benefit, the surgeon in charge of the case deemed it advisable to amputate the limb above the knee.

Immediately after amputation the popliteal artery was injected with gelatine and carmine. On dissecting the parts, it is noticed that the ligaments, the articular cartilages, as well as the medulla contained in the cancellated tissues of the bone, appear to be comparatively healthy, but the interior of the joint is filled with a soft spawn-like structure, which in parts is deeply injected with carmine; but it also contains a vast number of non-vascular white particles, looking very like grains of boiled sago. This soft, spongy structure has grown over a portion of the articular cartilages, and extends outwards almost to the subcutaneous tissues. On careful examination the sinuses which were supposed to pass into the joint seem to be connected with small cavities which have formed in the spawn-like tissue above noticed, but which do *not* pass into the joint. It is evident that the soft, vascular, spongy tissues beneath the integument, and which fill the knee-joint, caused the swollen appearance and gave rise to the doughy-like feel which was communicated to the fingers by pressure made over the joint before the limb was removed.

On making sections through this spawn-like soft tissue, and examining them under a low power, we find it consists of a delicate fibrous matrix crowded with cells; in the meshes of this fibro-cellular matrix there are numerous clusters of large nucleated cells, among which we see a considerable number of many nucleated giant cells; these clusters of cells are non-vascular, the reticulum at their periphery being denser than that in the centre of the collection of cells. The presence of these granular bodies in the vascular fibro-cellular tissue produces the soft spawn-like material of which this specimen is a good example, and which reminds us of the conjunctiva when affected with trachoma. This spawn-like tissue not only occupies the site of the synovial membrane, but extends over a portion of the articular cartilages, like a thick pannus covering the cornea; it has grown into and almost filled the cavity of the joint; and has induced a considerable amount of thickening of the surrounding subcutaneous tissues, producing on manipulation the characteristic doughy feeling of "pulpy degeneration of the joint."

In consequence of the new growth destroying the synovial membrane, and as it increases becoming incorporated with the articular cartilages, the nutrition of these cartilages is seriously interfered with, their protoplasm proliferates in an irregular manner, and many of the young cells thus produced degenerate into pus, the articular cartilages perish, and the spawn-like tissue then comes into immediate contact with the calcareous lamina which covers in the end of the bones. But this lamina, as I have explained, is formed and repaired by the cells of the deeper layers of the articular cartilages (p. 10), so that after the cartilages have been destroyed the calcareous lamina disintegrates, and the cancellated tissue of the bone, with the medulla it contains, is brought into immediate contact with the new growth which has sprung from the synovial membrane. Caries of the ends of the bones is thus not unfrequently a result of pulpy degeneration of the knee or other joints. While these changes are taking place the ligaments and all the structures entering into the formation of the articulation are destroyed, their place being occupied by the spawn-like growth which the old writers on surgery found to be of so incurable a nature that they were in the habit of describing it as malignant.

Pulpy degeneration may arise as a consequence of chronic, as well as of acute inflammation of the synovial membrane, but I am equally sure that the disease not unfrequently originates in a low scrofulous form of inflammation, the tendency of the malady from the first being to the formation of the granular bodies in the fibrous interstices of the synovial membrane, the disease running very much the same course as that of granular conjunctivitis, its circumstances being modified by the difference in the surroundings of the diseased structures. In fact, the synovial membrane of joints, under the influence of disease, shows, in many respects, a closer affinity to the mucous than to the serous tissues.

The growth of the spawn-like material above referred to, may, as I have before remarked, supervene on serous or muco-purulent inflammation, among persons predisposed, either from hereditary taint or from an acquired disposition, to the development of scrofulous inflammation, but synovitis in an otherwise healthy person does not frequently lead to pulpy degeneration. And I have no doubt whatever that we only too frequently meet with cases where it is evident from the first appearance of the symptoms that the growth of these granular non-vascular collections of cells in and around the synovial tissue, is, if not the absolute cause, at any rate the chief influence that gives the diseased action its characteristic features. And when once this granular structure has been abundantly produced, the circulation in the part becomes so much interfered with that degeneration and suppuration, not only into the joint, but also into the soft structures external to it, take place, and so disorganization of the articulation occurs. This is the general course of the disease; nevertheless, we sometimes meet with instances such as the first I related, in which it appears that the morbid action has subsided, and, so far as we can judge, the soft structures have resumed a healthy condition.

But, like a person affected with trachoma, the tissues involved in pulpy degeneration may seem to have resumed their normal functions, but the altered action, when once roused into activity, although it may be quiescent for a considerable time, too commonly bursts again into activity upon some trivial exciting cause, because it is a constitutional affection. In fact, it would almost appear that suppuration, and with it the absolute destruction of the tissue involved in this pulpy or granular disease of the joints, is the only means by which the abnormal growth can be removed; nevertheless, we naturally endeavour to avoid this risk, and so take all the means in our power during the early stage of the malady to stay its progress in order that a permanent cure may, if possible, result without so grave a complication as suppuration of the joint. In spite, however, of our best efforts, most of the articulations affected with the disease we are considering suppurate, abscesses and fistulæ form in the part, the patient's health suffers very materially, and it is a question as to what further treatment is necessary to preserve, not so much the limb, as the patient's life.

In the earlier stages of the disease, the soft, doughy-like feeling of the enlarged joint, absence of fluctuation, and the limb being extended and easily movable, are characteristic symptoms of this form of disease; the thermometer affords us valuable information as a guide to prognosis. The temperature of the affected joint should be taken morning and evening and compared with that of the sound limb. If we find a marked and persistent increase of heat, say from four to seven degrees, in the affected joint, we may feel sure that changes are going on in the part, which, if not sufficient to excite suppuration, border closely on that stage of the disease. Absolute rest, belladonna, pressure, and ice applied outside an elastic bandage may arrest further mischief, in conjunction with good hygienic arrangements, but my opinion is that, sooner or later, a joint affected with granular disease which has indicated a persistent high temperature, although it may improve for a time, will hardly recover its normal condition. If no persistent high temperature has been observed, there is a hope of recovery; but, unfortunately, it is frequently impossible for us to know if the temperature of a diseased joint has not been persistently high at some time or other previously to the case coming under our care. A high temperature, therefore, such as I have referred to, accompanied by other symptoms of granular disease, is a distinct warning to us of serious mischief, but its absence is no proof that changes such as I have indicated may not have occurred, the parts having perhaps been comparatively quiet when the patient happens to come under our observation; our prognosis must therefore be guarded.

I have already described the plan of treatment to be adopted in the more favourable class of cases.

If the patient, in spite of these measures, continues to get worse, the actual cautery should be employed, the skin and connective tissue beneath it being singed in lines some four or five inches in length on either side of the patella; not only is the counter-irritation useful in cases of this kind, but the cicatrices which form as they contract exercise a certain amount of pressure on the pulpy tissue beneath. After the wounds caused by the application of the actual cautery have healed, counter-irritation should still be kept up over the joint for some time. Pressure by means of an elastic bandage must also be used.

Supposing suppuration has commenced, as in the case of D. C., it is possible that the matter may have formed external to the articulation; in fact, this is frequently found to be the case in this form of disease; crepitation may not be detected, but this might depend on the soft pulpy tissue having grown over the ends of the bone, and by filling the joint, mask this symptom.

Sir W. Fergusson was fond of repeating the formula that amputations are the opprobrium of surgery, and in no cases is this more certainly true than in diseased joints; unless the patient's strength is persistently diminishing, his digestive organs becoming impaired, and further efforts to save the joint are attended by risk to life, amputation should not be resorted to. In cases of advanced pulpy degeneration anchylosis of the joint may result if the parts are freely laid open, the granulation tissue broken down, and efficient drainage established, the limb being kept at perfect rest. I have watched cases of granular disease of the knee, ankle, and elbow-joints which, although very protracted in their course, have ultimately yielded good results. But you must give your patients affected with pulpy degeneration of the joints fair play, and one of the most essential conditions to their recovery is light and pure air, together with rest for the diseased joint.

After cutting into a joint affected with pulpy degeneration, suppuration is rather to be encouraged for a time, and a strong solution of the chloride of zinc applied to the diseased tissues so as to destroy the abnormal growth. As soon as the sloughs produced by this application have separated, the hospital red lotion may be freely syringed two or three times a day into the wounds; as the suppuration diminishes, iodoform with tannic acid may be dusted over the granulating surfaces.

With reference to excision I shall have more to say in my Lecture on diseases of special joints; I may here remark that in cases of incurable pulpy degeneration of the synovial membrane in adult patients, I should, as a rule, amputate the lower third of the leg or of the thigh, rather than excise the ankle or knee-joint. On the other hand, in cases of pulpy degeneration of the joints of the upper extremity, we are seldom justified in performing an amputation, at any rate until after resection has failed to remove the local affection.

HYDROPS ARTICULI HYDRARTHROSIS.

Hydrops articuli consists essentially in a slowly increasing collection of serous fluid in the synovial membrane and bursæ surrounding one or more of the larger joints. It has been correctly said to resemble hydrocele in its pathology, and, I may also add, in its treatment. The disease may run its course from first to last without pain, or any other sign of inflammation. Sometimes, however, the increasing accumulation of fluid in the joint is preceded by symptoms of synovitis. Hydrarthrosis occurs most commonly among men before they have reached forty years of age. It often appears in the corresponding articulations on either side of the body; it is seldom met with in any other joint except the knees. In cases of hydrops articuli the affected joint becomes gradually very much swollen; the skin retains its natural appearance. The diagnosis between this disease and granular degeneration of the synovial membrane in its earlier stages is unmistakable, for in hydrarthrosis fluctuation can be distinctly felt over any part of the swelling, and with an aspirator a considerable quantity of a straw-coloured serous fluid can readily be withdrawn from the joint, after which the articulation assumes its natural shape and appearance.

In these cases the form which the affected joint assumes, not only depends on the distension of the synovial membrane, but also upon the bursæ connected with the joint being also full of fluid. The patella seems to ride upon a bag of fluid, and the bursæ in the popliteal space, as well as those beneath the tendons of the extensor muscles, produce irregular elevations.

Persons suffering from hydrops articuli seldom complain of pain. Even when pressure is applied over the affected joint the movements of the articulation are usually free, and the patient can generally walk about; but as the accumulation of fluid increases, the limb becomes weak, and then more or less painful after exercise. Hydrarthrosis, although it may ultimately render a person unfit for active employment, does not, as a rule, lead to destructive changes in the tissues entering into the diseased joint.

The treatment of these cases depends very much upon the age and health of the patient. Unfortunately, it usually develops itself among comparatively young men. In elderly people, especially those of a rheumatic or gouty temperament, we should hesitate before undertaking any more active treatment than the employment of counter irritation to the skin over the affected joint, and in supporting the part by means of an elastic knee-cap or bandage. On the other hand, among younger persons and those more advanced in life if otherwise in sound health, especially if their bread depend upon their power to work, we may, if the condition of the joint is such as to prevent their gaining a livelihood, draw off the contents of the joint with the aspirator and inject a solution of one part of tincture of iodine to two of water into the synovial membrane, treating the disease much the same as we should a hydrocele. Our object is to establish a slight amount of inflammation in the part; we consequently allow the injection to remain in the synovial membrane; on withdrawing the aspirator the external wound should be covered with collodion, and the limb carefully kept at rest on a splint until the inflammatory action has subsided. I have opened the joints of patients in this manner, and as yet have never seen excessive inflammatory action excited in the articulation; some of these cases have done well, and none of them, so far as my experience goes, have suffered any ill consequences from treatment of this description. A case of this kind was admitted into the Henry Hoare ward in November: the following abstract of his history was made for me by my dresser, Mr. J. W. Baterham :—

R. L., aged thirty-two, a temperate man who has always enjoyed good health, and has never suffered from rheumatism, some six months ago first noticed that his left knee began to grow stiff and somewhat painful after exercise; the swelling of the joint gradually increased to such an extent as to prevent his doing his work as a porter; under these circumstances he was admitted into the hospital.

The patient's left knee-joint was then extremely swollen, bulging out above and on either side of the patella as well as into the popliteal space; on percussion fluctuation could be felt in all directions; the skin covering the joint was of its natural appearance. So long as the patient remained in bed he was perfectly comfortable, but he was unable to do more than limp about the ward in consequence of the pain which he then suffered from in the joint. Scott's dressing was applied round the affected knee with an elastic bandage over it, but as the symptoms did not yield to this treatment, I aspirated the joint and drew off four and a half ounces of fluid, after which equal parts of tincture of iodine and glycerine were injected into the synovial sac. This injection caused a slight amount of inflammation, the local temperature rising for several days three degrees above that of the sound limb.

The patient was discharged from the hospital after ten days, but returned in the course of two months, the knee being again much distended with fluid. I therefore drew off the contents of the synovial membrane as before, and injected an ounce of tincture of iodine into the articulation. This treatment did not seem to excite more local action than the previous injection had done, but the swelling of the joint and pain from which the patient had suffered entirely disappeared, and has not returned up to the present time; in fact, our patient was cured and able to return to his work.

This case illustrates the line of treatment which seems to me most effectual in this class of patients, and, so far as my experience goes, it does not lead to more severe action in the joint than is necessary to stop the flow of serous fluid from the surface of the synovial membrane into the articulation.

LECTURE XIV.

CHRONIC OSTEO-ARTHRITIS (RHEUMATIC GOUT—ARTHRITIS DEFORMANS).—ATAXIC ARTHROPATHY.

CHRONIC osteo-arthritis is characterized by pain, stiffness, and deformity of one or more joints, associated with the irregular growth of new osseous tissue round the articular surface of the affected bones. The disease which leads to the remarkable outgrowth of the bone (osteophytes), as Dr. E. Barlow observed many years ago, is a hybrid malady, in which gout and rheumatism are combined. It is admitted by almost all authorities that the deformed extremity of the bone found in this affection is seldom, if ever, due to pure gouty inflammation; that is, these deformities are not present in joints having deposits of lithate of soda in the articular cartilages, synovial membrane, or soft·tissues surrounding the articulation. It is true, in gouty joints we sometimes find the ridges of bone corresponding to the junction of the articular cartilage with the synovial membrane are very prominent, but this condition of things is not peculiar to the joints of individuals who have suffered from gout or rheumatism, and it can hardly be confounded with the remarkable outgrowths of bone which are characteristic of chronic osteo-arthritis.

Among high caste Hindoos, who never touch alcohol, and consume hardly any meat, such, for instance, as the men who formerly composed the greater part of the Bengal native army, chronic rheumatism was one of the most common causes for which men were invalided, and yet I cannot remember having seen a case of osteo-arthritis among these old soldiers, or, in fact, in any other class of Hindoos. Among horses, changes in the joints identical with those seen in patients suffering from osteo-arthritis are frequently met with, and cannot depend on gout. This fact rather confirms the idea I have above referred to, that pure gout or pure rheumatism does not give rise to the outgrowths of bone common in instances of osteo-arthritis.

I shall presently describe the condition in the articular ends of bones sometimes met with in persons affected with locomotor ataxy, abundant osteophytes occasionally being formed round the extremities of the soft bones.

Lastly, I would direct your attention to this preparation, taken from the limb of a patient who had undergone resection of the knee-joint nine years before his death. The expanded ends of the tibia and femur are surrounded by outgrowths of bone precisely resembling those met with in cases of osteo-arthritis. Consequently, although by far the majority of cases of deformity of the bone, such as I have referred to, are due to the disease we are now considering, nevertheless, osteophytes, or in other words, the excrescences of bone seen so frequently in cases of osteo-arthritis, may be produced by other and totally different causes.

It will save time, and perhaps assist us in forming something like a definite idea regarding the circumstances of this disease, if I refer to one or two points connected with its etiology.

In the first place, I may observe that if we really wish to study this form of disease we should work in the wards and the dead-houses of our large Metropolitan Work-house Asylums, or among the poorer classes in many of our rural districts; on the other hand, we know that the inhabitants of certain countries hardly ever suffer from gout, and among these people osteo-arthritis is unknown. But wherever rheumatism and gout prevail, or rather the repeated and chronic synovitis accompanying these affections, there persons among all classes of society, but most frequently among the lower orders, suffer from osteo-arthritis.

We frequently find in this disease that almost all the joints of the body become affected; the abnormal action may, however, be confined to the hip, the shoulder, or any other articulation; but we may lay it down as a rule that osteo-arthritis only manifests its presence characteristically in the articular cartilages and the cancellated tissue of the bones in the proximity of the articulations. The shafts of the affected bone may become sclerosed, but this alteration is by no means a common or peculiar feature of the disease we are considering.

In illustration of the course which this affection follows, and of the pathological changes observed after death, I may refer to instances of osteo-arthritis of the knee-joint, because I have here an injected specimen of the knee, taken from the body of an old man who was run over and killed. Finding his right knee was extensively diseased, I injected the femoral artery immediately after death, and subsequently excised the knee-joint and a part of the bones of his foot.*

The commencement of this disease in the knee (or any other joint) is marked by serous synovitis with slight pain, frequently not sufficiently severe to prevent the patient from moving about. Month by month the stiffness and pain in the knee increase; the part becomes more swollen; ultimately the ham-string muscles may become contracted, so that the leg is slightly bent backwards and inwards and the foot somewhat everted.

In its early stages effusion of fluid into the joint exists, and gradually augments in quantity, so that after a time the knee may become much increased in size. The bursæ in connection with the joint, as well as those around it, are frequently distended with fluid, and so the knee often presents a nodulated, swollen condition, the skin covering the part retaining its normal appearance. If the joint is alternately flexed and extended, articular crepitation becomes manifest. In the later stages of the disease the synovial fluid is often absorbed, but the grating produced by rubbing the surfaces of the bones against one another becomes more evident; it is perceived by the patient himself in almost every movement of the joint, and may sometimes be heard by the bystanders.

---

* In the account of the symptoms presented by a case of chronic rheumatic arthritis I have closely followed the admirable description of the disease given by Dr. R. Adams ("A Treatise on Rheumatic Gout," by Dr. R. Adams, M.D. Second edition. Page 190).

Subsequently the patella and the articular ends of the femur and tibia become enlarged, and nodules of ossific matter can be recognized, forming round the extremities of the bones, especially above the articular surfaces of the condyles of the femur and the metacarpal bones of the thumb.

Loose cartilaginous or fibroid bodies may almost always be felt in the affected joint; they are sometimes as large as a filbert, and can generally be moved from one part of the synovial sac to another. Should one of them by chance become lodged between the ends of the femur and tibia during the time a patient is in the act of moving his limb, they cause him considerable and sudden pain, followed by an exacerbation of the synovitis from which he suffers.

Although the patient may, in the course of years, become bedridden if both knees are affected, still there is seldom any very acute suffering in this form of disease, even in its more active and earlier stages. Suppuration of the joint does not occur; but we have evidence of chronic synovitis, enlargement of the articular ends of the bones; on movement or pressure crackling in the joint, and the presence of loose bodies in it, together with the deformity of the affected joint and limb; and, lastly, perhaps an immovable condition of the articulations.

On examining the ends of the bones implicated in cases of osteo-arthritis, we find, as in this specimen, that the synovial membrane is deeply congested and thickened, and projecting from its surface are a number of fibrous excrescences which hang into the interior of the joint, and which, becoming detached, form the loose bodies above referred to.

The semilunar cartilages have entirely disappeared, together with the greater part of the articular cartilages.

The ends of the bones and the patella entering into the formation of the joint are greatly enlarged. You notice how broad and excavated the articular surface of the tibia has become, its cartilage and the calcareous lamina of bone having entirely disappeared.

In studying the pathology of this affection, we must remember that in all cases the early symptoms of the disease are characterized by a synovitis, existing for months or years: and what does this mean, but that during the greater part of that time the structures entering into the formation of the affected joint are in an abnormal condition, one of the results being a diminution in the vitality inherent in the cells upon which the normal condition of the semilunar and articular cartilages depend? In the early stage of the disease the free surface of these cartilages are yellowish, rough, and undergoing fibroid degeneration. The subcartilaginous osseous lamina, depending as it does for its growth and maintenance on the articular cartilage-cells, also degenerates, and is frequently absent in cases of osteo-arthritis, so that the cancellated tissue of the bone, with its medullary contents, are laid bare. In an injected specimen such as this, we see the medulla projecting from the open end of the bone into the joint as a granulating or fungating mass. Some of this medulla has undergone ossification, and the newly-forming osseous tissue being crowded with bone-cells, has passed into a state of sclerosis, producing this dense ivory-like bone which projects in ridges and smooth nodules from the articular extremity of the femur.

In this particular specimen the degeneration probably commenced in the articular cartilages of the tibia, and as the condyles of the femur came to press, by means of the contraction of the muscles, upon the open soft cancellated tissue of the head of the bone, the end of the tibia was forced outwards, and some of its medulla, pressed over the outer margin of the bone, in conjunction with the cells of the periosteum, has become ossified and thus formed this crown of new bone round the articular surface of the tibia. As I have before remarked, you may observe an analogous pathological condition existing in this femur, amputation having been performed some years after excision of the knee-joint. The lower end of the femur is surrounded by an osseous growth, because its condyles having been excised, the pressure of the tibia against the open soft cancellated tissue of the femur has squeezed and flattened the end of the bone, forcing outwards some of its medulla, which, with the periosteum, has produced these fringes of new bone round the end of the femur. In another specimen I have here you see a crown or ridge of new bone surrounds the upper extremity of this tibia, removed many years after excision of the knee-joint had been performed.

I must, however, revert to this injected specimen of osteo-arthritis. We find that a portion of the contents of the cancellated tissue of the end of the bone, or it may possibly be the articular lamina covering in the end of the bone, has become polished or sclerosed : in this and in most examples of the kind taken from the knee and elbow-joints, the ridges of sclerosed bone correspond to depressions in the opposite bone. In the head of the femur and humerus, the pressure being equal in all directions, the articular surfaces of the diseased bone are generally round and smooth.

The influence which the pressure of the bones, whether in supporting the weight of the trunk or from muscular action, has in the production of these osteophytes is often seen in specimens of the joints of the spine affected with chronic osteo-arthritis. In the majority of such specimens we find that ridges of osteophytes have formed on the anterior and lateral borders of the upper and lower surfaces of the vertebræ; the soft upper and lower surfaces of the bodies of the vertebræ have been pressed outwards by the weight of the trunk and head; but although the cartilages of the articular processes of the vertebræ have also undergone extensive fibroid degeneration, we do not find them surrounded by osteophytes, because the heads of the ribs have not pressed with sufficient force against the articular surfaces to produce the outgrowths of bone, such as we see round the bodies of the vertebræ.

With reference to the treatment of cases of osteo-arthritis, it is almost superfluous to remark that it is useless attempting to relieve the symptoms in joints affected by organized osteophytes, and which have become anchylosed. On the other hand, if the disease is properly treated in its early stages, it may generally be overcome in the course of six weeks or two months.

It seems to me essential in the treatment of patients affected with osteo-arthritis to attend to their diet; alcohol in any form should, I think, be absolutely prohibited, and the consumption of meat, fish, and eggs restricted to the smallest quantity. In fact, farinaceous food with milk, such as porridge, rice and milk, bread and butter, with cocoa and fruit, taken twice a day, is sufficient for most of these patients, and very many of them augment the severity of the disease, and render its cure impossible, by consuming far more food than is necessary for the work their bodies and minds have to perform.

It is often necessary to regulate the bowels by means of the purgative mineral waters, and the system is greatly relieved by pills containing a quarter of a grain of podophyllin with two of rhubarb, to be taken twice a day until they act freely on the bowels; under any circumstances the state of the alimentary canal must be carefully attended to.

With reference to baths, those patients who can afford it should go to the vapour baths at Mont Doré or Aix les Bains, but there are establishments in England, such as Buxton, Droitwich, and Ben Rhydding, suited for the treatment of cases of osteo-arthritis. Those persons who cannot afford to live in establishments such as those I have referred to will derive benefit from the use of the ordinary vapour bath for twenty minutes before going to bed. The bath should be used every night for a month or six weeks.

Damp, and especially chills, must be avoided by patients suffering from osteo-arthritis, and as a means to this end, flannel should be worn next the skin both night and day.

If the joints are swollen and painful they should be surrounded with cotton wool, outside which an elastic bandage should be tightly bound for some three hours each day. The bandage being removed, friction should be employed for half an hour or so. In this way equal parts of cod-liver oil and the ung. iodid. co. may be rubbed into the skin once or twice a day.

Lastly, I have known so many cases of osteo-arthritis relieved by electrolysis, that I think the continued current should be tried in all instances of this disease; if it fails, as our best efforts will at times, no harm can be done, and as I have said before, I have seen many patients greatly relieved by electricity after other remedies have been tried in vain. I would, however, insist on the fact, that treatment of this sort, to be useful, must be resorted to in an early stage of the disease. It is too often postponed until all other remedies have failed, that is, until irreparable damage has been done to the articular cartilage and the ends of the bone, when, in fact, the time has passed for anything more than the palliative treatment of the disease.

There is, of course, a large number of patients suffering from chronic osteo-arthritis who are unable to resort to bathing establishments; under these circumstances, the other means I have referred to should be employed, and even in the advanced stages of the disease relief may be obtained by well-applied friction to the affected joints, the compound iodine liniment being rubbed into the part, and the joint carefully shampooed for a quarter of an hour night and morning, and subsequently protected with a flannel bandage.

Damp localities must, if possible, be avoided as places of residence, and the patient's diet regulated according to his condition in life, and the ideas you have formed as to the correct regimen in cases of rheumatic gout.

The enlarged bursæ round the joints, so constantly met with in cases of this disease, may be emptied of their contents by means of the aspirator, and then a solution of one part of iodine to six of glycerine injected into the sac of the bursa. I need hardly remark that we must proceed with caution in cases of this description. Some patients seem to be intolerant of any such treatment, and inflammation is readily excited in the bursa and neighbouring synovial membranes.

Excision of the knee and other joints of the body have been performed for the enlargement and deformities arising from osteo-arthritis; in the case of the smaller articulations, operations of the kind are unquestionably justifiable, but with reference to the knee and other large articulations, we have to consider the risk to life which excision of these joints entails, especially among persons advanced in life, as compared with the pain and inconvenience caused by the disease. In this respect each case must be judged of on its own merits.

ATAXIC ARTHROPATHY.

The osseous and articular lesions which occasionally occur in the course of locomotor ataxia have specially engaged the attention of Professor Charcot, of Paris; and were brought before the Pathological Society of London on February 5th, 1880, by Dr. Buzzard. Considering the interest this subject has attracted in France, it is remarkable that the first living specimen of the disease we are considering was exhibited before a metropolitan medical society by Dr. Buzzard on the occasion referred to.

Dr. Buzzard mentioned the case of a woman, Elizabeth W., aged fifty. The patient had suffered for about eleven years from typical "lightning" pains in her legs and arms, and had been affected for an equal time with attacks of the *crises gastriques* of Charcot, attacks in which there is pain in the stomach and chest, with continual retching and vomiting, occurring at irregular intervals, sometimes as many as four in four months, the longest period of exemption having been eight months. This patient presented other symptoms of tabes, such as the ataxic gait, very small pupils not reacting to light, but during accommodation, analgesia of extremities, defective muscular sense, and absence of patellar tendon reflex. In October, 1878, whilst walking quietly along the ward, her right femur was fractured through its neck. In July, 1879, whilst retching in bed, her left hip-joint suddenly "bulged out." Since then she has been unable to use either leg.

Dr. Gowers lately showed, at a meeting of the Pathological Society, an interesting specimen of the osseous lesions found in locomotor ataxia. This specimen consisted of the elbow-joint from a patient, aged forty-five, who had suffered from this disease. Four years after the disease commenced, the symptoms were well marked in both arms and legs, when he happened to fall and strike his right elbow. He used the arm next day without inconvenience, but the joint rapidly became much swollen, and a doctor whom he consulted thought some bone had been broken. Two months later the joint was enormously swollen, abnormally mobile, and loose bone could be felt in it. There was not, nor had there been, any pain in the joint. The swelling slowly lessened. Six months later he died from the effects of a painless but extreme pleural effusion.

The spinal cord presented the usual lesion seen in cases of locomotor ataxia. In the elbow-joint the external condyle of the humerus had been split off, and the coronoid process of the ulna was also fractured. The ends of the bones had lost most of their articular cartilages, and were eroded. The synovial membrane was covered between the bones by villous projections, some fine, others large. There were also two pieces of bone which could not be accounted for by fracture; one, about half an inch square, was above the coronoid process and projected into the cavity of the joint; the other was a plate of bone in the outer wall of the synovial sac about an inch square, but apparently in two pieces. The case was of interest as illustrating the joint lesions met with in ataxy, and on account of the painless character of the swelling, and of the fatal pleural effusion.

Professor Charcot is disposed to consider the alteration in the nutrition of the osseous tissue the prominent fact, the joint-changes and the spontaneous fractures being secondary manifestations of the fault of nutrition of the bone, dependent on lesions of the nervous system. According to the same authority, the extremely rapid wearing away of the articular extremities is the principal character which distinguishes ataxic arthropathy from osteo-arthritis. Dr. Buzzard remarks that it was noteworthy in reference to E. W., above referred to, that in cases of spontaneous fracture due to tabes, it was common to find a more than usually exuberant callus thrown out. Referring to the question, where was the seat of lesion in the nervous centres? Dr. Buzzard remarked that Charcot's original idea, that this was probably to be found in the anterior cornua of the cord, had not been supported by the results of three recent autopsies of arthropathic cases in which the cells in the anterior horns of the cord had been found perfectly healthy. On the other side, he referred to the frequency with which extensive changes in the cells of the anterior horns had been found in cases of progressive muscular atrophy, which presented no such osseous lesions as those above referred to. Dr. Buzzard drew attention to the remarkable fact that the symptoms known as *crises gastriques*, which were comparatively rare in tabes (he had only met with them eight times, and in only four of these well-pronounced, in a range of fifty-six cases of tabes in his own experience), were extraordinarily frequent in these cases of arthropathy. They were present in two out of his own four cases; they occurred in the only instance of spontaneous fracture in a tabetic patient which Vulpian had witnessed, and in a range of sixteen other cases of arthropathy, which he had collected from French sources, six were characterized by the gastric phenomena. This association was too remarkable to be attributed to accidental coincidence.

As the gastric symptoms might, with some confidence, be ascribed to sclerosal invasion of the roots of the vagus, Dr. Buzzard suggests the probability that a change in some structure contiguous to these in the medulla oblongata might be found to be the lesion giving rise to the altered nutrition in the osseous system, and he thought that it was in this quarter that pathological anatomy might usefully direct its inquiries. Without claiming for this idea any position beyond that of a legitimate hypothesis suggested by the clinical association of symptoms, Dr. Buzzard believes that the discovery of a centre for nutrition of articulations in the medulla oblongata would afford much aid towards the explanation of the remarkable association of cardiac complications with articular rheumatism, as well as the occasional high temperature witnessed in the latter disease, besides, perhaps, helping to throw light on the obscure pathology of osteo-arthritis.

According to our present knowledge, the joint-affection usually sets in early in the course of ataxia, and is at first marked by great effusion into the synovial cavity of the affected joint. This synovitis is in general followed by complete destruction of the joint; the ligaments are relaxed, cartilages eroded and completely worn away, and the articular ends of the bones become absorbed. These changes take place without pain, and the irregular, loose, flail-like movements of the joint can also be accomplished without pain.

In addition to these joint-changes, the affected bones are subject to spontaneous fracture, either in their shafts or near the articular ends. Subsequently there is often a very abundant callus formed round the ends of the fragments, which may envelop all the deep structures in one unyielding mass; but when occurring at the neck of the femur the fracture remains ununited. While, in the main, there is an absence of osteophytic growths round the joints, specimens are not wanting to show osseous enlargement of the great trochanter of the femur, whilst in other cases ossification of the rectus tendon proves that outgrowths of bone, such as those met with in osteo-arthritis, may be present in cases of tabes.

The rapidity and painlessness of the process, and the marked atrophic changes met with in the joint-affections of tabes, are characteristic of this disease, and lead, in connection with the other symptoms present, to the conclusion that they depend upon nerve-lesions. Dr. Gowers' case, however, seems to indicate that these sudden and almost painless effusions of serous fluid are not confined to the joints, but may take place into other serous cavities.

The fractured bones we meet with from time to time in instances of locomotor ataxy probably depend upon faulty nerve-influences deranging the healthy nutrition of the osseous and other structures of the affected part. In instances of leprosy, a disease, however, hardly depending upon central nerve-lesions, we not unfrequently see patients suffering from extreme muscular atrophy; but the bony frame-work, together with the skin, remains unimpaired. In other cases of this affection the bones, particularly of the hand and foot, are destroyed by a process of progressive ulceration, which is apparently not very unlike that which occurs in tabes.

With reference to the lesions met with in about 10 per cent. of the patients suffering from locomotor ataxy, it is evident that joint-complications commence with serous effusion into their synovial membranes. It is difficult to explain how this condition of things arises in connection with a central lesion of the nerves, but the mere distension of the synovial membrane with fluid for several months together, combined, in all probability, with mal-nutrition of the ends of the bones consequent on the alterations in the spinal cord, must lead to destruction of the articular cartilages. These cartilages, as they disappear, leave the calcareous lamina of bone denuded, and as I have already explained (p. 21), this lamina is formed from, and repaired by, the deeper layer of the cartilage-cells; so that after the removal of the cartilage, the calcareous lamina of bone gradually disintegrates, and not being re-formed, the cancellated structure of the bone is laid open and becomes soft and carious, producing the condition which is so well shown in the specimen exhibited by Dr. Gowers at the meeting of the Pathological Society.

There is, therefore, a certain analogy between the joint-affections of tabes and that found in cases of osteo-arthritis, but in this latter disease there is no loss of muscular power, and so the affected bones are forcibly drawn together and their extremities crushed outwards. In locomotor ataxy, the wasted muscles surrounding the articulation are unable to contract and squeeze the softened osseous surfaces against each other. Moreover, in tabes the patient is often unable to bear the weight of his body upon the affected limb, during the premonitory stages of the disease; in cases of osteo-arthritis, he moves about, and so increases the tendency of the muscular action to flatten out the extremities of the denuded bones.

I do not contend that because the alterations in joints found in some cases of ataxy and osteo-arthritis are somewhat analogous in appearance, that these affections arise from the same cause; on the other hand, the lesions in tabes are primarily due to disease of the spinal cord, and those of osteo-arthritis to chronic synovitis, without indications of central nerve-lesions.

Supposing, however, that the peculiar condition of the bones entering into the formation of certain joints in tabes are referable to the causes I have indicated, it only removes the origin of the disease one stage backwards, for it may be argued if the synovitis is in the first instance due to nerve-lesions, which I admit, then the affection of bones may likewise be produced by the same cause. I do not, however, think that there are legitimate grounds for coming to this conclusion, nor does the fact of the spontaneous fracture of the bones in tabes help us to a solution of this problem, because, in these cases, so far from a wasting of the bones at the site of fracture occurring, such as that found in diseased joints associated with this affection, we find that there is an abundant callus and speedy reparation of the broken bone in instances of locomotor ataxy.

From a clinical point of view, I am sorry to confess that we can do even less to relieve the condition of a patient suffering from joint-complication originating in tabes, than we can in confirmed instances of osteo-arthritis.

LECTURE XV.

DISEASES OF SPECIAL JOINTS. MORBUS-COXARIUS —DISEASE OF THE HIP, THE KNEE, AND ANKLE-JOINTS.

EXCLUDING those cases of disease of the hip-joint which originate external to the synovial membrane, morbus-coxarius may commence in the medulla contained in the head and neck of the femur or of the acetabulum; it may begin in the synovial membrane of the joint, and, before puberty, in the soft structures situated between the epiphyses and the diaphyses of the upper extremity of the femur, as well as in the epiphyses of the acetabulum. It is, however, almost impossible for abnormal action to be confined for any length of time either to the bone or any other structure entering into the formation of the joint, because prolonged irregular action in any one part of the articulation is almost certain to implicate contiguous tissues. This being the case, it will save reiteration if I commence this lecture with an account of the symptoms common to all cases of morbus-coxarius, irrespective of its origin. My remarks apply to the diagnosis of hip-joint disease in its earlier, rather than its more advanced stages, when there can seldom be much difficulty in determining its nature.

I may here observe that hip-disease is an affection of child-life—about two-thirds of the cases being under ten years of age, four-fifths of the whole number not having reached the adult period of life.

A patient affected with morbus-coxarius in its early stages (whatever may have been the origin of the disease) suffers from a certain amount of stiffness in the affected joint. This stiffness of the joint may depend upon one of two causes, or perhaps more frequently upon a combination of these causes. First, from irritation going on in some part of the joint, reflex action is propagated through the spinal cord to the muscles surrounding the articulation, and from the spasm thus produced the head of the femur becomes firmly locked in the acetabulum. Secondly, if the synovial membrane of the joint becomes inflamed and distended with fluid, the ilio-femoral and pectineo-femoral ligaments, together with the tendons of the psoas, iliacus, and other muscles surrounding the articulation, press upon the inflamed membrane when the patient extends his femur on the pelvis. To relax these ligaments and muscles the patient involuntarily keeps his thigh fixed and flexed on the pelvis. The same position is assumed if the acetabulum or the head of the femur is rendered painful on pressure in consequence of the existence of inflammation within the cancellated structure of the head of the bone.

Stiffness of the Joint.—In order that we may determine if stiffness of the hip-joint exists, the patient must be very carefully examined. His clothes having been removed, observe in the first place if he suffers from any symptoms of spinal disease, such as angular curvature; notice if there is tenderness on pressure over the spinous processes of the vertebræ, or stiffness in the back when the patient bends forward in the act of picking up a small object from the floor.

As the patient stands naked, observe if he endeavours to save the affected limb by slightly flexing it and resting more firmly on the sound one. The patient must then be laid flat on his back upon a hard smooth surface, such as the floor or table: place the first finger of one hand on the anterior superior spinous process of his ilium on the affected side, and gently flex and extend the corresponding thigh; while doing so watch if the patient's pelvis moves with his femur, which will be the case if the head of his thigh bone is locked in the acetabulum. Compare the movements of the diseased with the sound limb—you can flex and extend the latter freely without moving the pelvis. When manipulating the diseased limb it not unfrequently happens that no movement of the spinous process of the ilium with the femur is noticed until the thigh is either fully flexed or extended. It is quite possible, however, that the movements of the thigh on the pelvis may be limited in the manner I have described in consequence of a psoas or iliac abscess, or, as in a case I will relate to you presently, from inflammation in the soft tissues covering the trochanters. In all doubtful cases, therefore, not only ascertain if the movements of the joint are perfect in complete flexion and extension, but also if the head of the femur rotates in the acetabulum when the thigh is semi-flexed on the body, in which position abscesses situated outside the joint would not affect the passive movements of the head of the femur on the pelvis. The diseased limb being semi-flexed, grasp the patient's thigh with one hand and rotate the head of the femur in the acetabulum; if its motion is free under these circumstances, the patient not being under the influence of anæsthetics, it is hardly possible that disease of the hip-joint exists.

Head of Femur Fixed in the Acetabulum.—In almost all cases of morbus-coxarius—for reasons above referred to—the diseased limb is more or less flexed on the body, the head of the bone in this position being fixed against the pelvis. In order to ascertain if this state of things exists, as the patient lies on the table observe if the spines of his lumbar vertebræ rest in contact with the flat surface on which he reclines. If there is disease of the hip-joint, the corresponding thigh will be more or less flexed on the body (unless in very exceptional cases); should the patient's lumbar spine be arched forwards, flex the diseased limb still more until the spines of his vertebræ rest in contact with the table; leave the diseased thigh flexed to this extent, and fully extend the sound limb; the lumbar spines will not move forward during this manipulation, so long as the diseased limb remains flexed on the body; now place the fingers of one hand between the patient's lumbar spine and the table on which he reclines, and extend the diseased limb gently and slowly; if the femur is locked in the acetabulum by muscular rigidity or from any other cause, as the diseased limb is being extended the brim of the pelvis will be tilted forward, and with it the movable lumbar vertebræ. This movement may be repeated; each time the limb is fully flexed on the body the patient's spine will rest upon your hand placed between it and the surface upon which he reclines; as the limb is again extended the patient's vertebræ are felt to move slowly forward into an arched position.

In cases of morbus-coxarius, therefore, not only will the hip-joint be stiff in its movements, but also in by far the majority of cases the femur will be flexed on the pelvis, and in this position locked in the acetabulum, under which circumstances, if the diseased limb is extended, the pelvis is tilted forwards, and the lumbar spine becomes arched. But in the earlier stages of the disease, if the patient is placed *completely* under the influence of anæsthetics, the head of the femur will move with perfect freedom in the acetabulum. Subsequently, false anchylosis may occur as a result of the disease, and then the movements of the joint are impaired, although the patient may be fully under the influence of chloroform.

Apparent Lengthening of the Diseased Limb.—Patients suffering from morbus-coxarius, when lying flat on their back, frequently appear to have marked lengthening of the affected limb. This condition is due to contortion of the pelvis, and not to the diseased limb being really longer than the sound one. In a case of this kind, if you draw a line through the two anterior superior spinous processes of the ilium, you will find that the pelvis on the diseased side is lower than on the sound side. The explanation of this state of things is as follows:—

Supposing a patient suffering from morbus-coxarius has his thigh slightly flexed and abducted in consequence of muscular spasm, or it may be by anchylosis, in attempting to walk he cannot bring this abducted foot to the ground; in order, therefore, to get the diseased limb parallel with the sound one he raises his pelvis on the sound side so as to tilt it over, or, in other words, lower it towards the diseased side, and thus allow the foot to be brought to the ground. As the patient, therefore, lies on his back, the abnormal condition of the brim of his pelvis produces an apparent lengthening of the diseased limb. The loss of movement in the affected hip is also in some measure transferred to the flexible lumbar spine, which in a case of this kind acquires sufficient power of motion to compensate for the loss of movement in the stiff hip-joint; the lumbar spine becomes curved towards the diseased side.

Apparent Shortening of the Affected Limb.—Shortening of the limb in morbus-coxarius may, in the advanced stages of the disease, be due to absorption of the head of the bone, in rare cases to dislocation of the head on the dorsum of the ilium, or to separation of the neck of the femur from the head —the result of epiphysitis; but apparent shortening, like the lengthening of the limb, may be caused by muscular action. If from rigidity of the muscles the thigh, instead of being abducted, is fixed in the acetabulum and adducted, the patient in endeavouring to walk is unable to bring the diseased limb into the middle line; and to overcome this difficulty he raises the pelvis on the affected side, producing curvature of the lumbar vertebræ towards the sound side. The brim of the pelvis, being tilted downwards on the sound side, produces an apparent shortening of the diseased limb.

Muscular Spasm.—As I have already remarked, one of the earliest indications of hip-disease is connected with muscular spasm, causing stiffness of the joint and malposition of the limb, which disappear under the influence of anæsthetics, and may in like manner pass away under appropriate treatment, leaving the movements of the joint perfectly free.

In the earlier stages of morbus-coxarius, when the patient is laid flat on his back, and his thigh is extended, the adductors, particularly the longus femoris, forms a well-marked rigid band extending from the pelvis to the femur; these muscles, as well as the synovial membrane of the joint and the head of the bone, receive branches from the obturator nerve. The abnormal nerve-action in these cases is not confined to the excitation of spasm, but the affected muscles also waste away in hip-joint disease; nevertheless, the obliquity of the fold of the buttock noticed on the diseased side is by no means constantly due to wasting of the muscles in this region, but rather to the position in which the patient stands. If you examine the buttock of a healthy person when in the erect posture, the transverse character of the gluteal fold will be noticed. If you now ask him to bear the weight of his body on one limb and slightly flex the other limb, the transverse character of the fold of the buttock will at once disappear, and it will become oblique as in the early stages of hip-disease.

Pain.—The pain, especially at the commencement of morbus-coxarius, is often described by the patient as being most severely felt in or above the knee, and along the inner part of the thigh—so much so that if you attempt to press on these parts, or to move the knee-joint, the patient cries out with pain; but perhaps he will allow you to make a superficial examination of the hip without complaining. This condition of things is due to the distribution of branches of the obturator nerve to the hip-joint and also to the skin covering the inner and lower portion of the thigh. But, as the hip-joint also receives nerves from the anterior crural and offsets from the sacral plexus, the region in which pain is complained of in morbus-coxarius is often very ill-defined: as a rule, it is most severe at night, for as the patient falls asleep the reflex irritation of the muscles—which he could partially control when awake—gains the ascendancy, and the limb starts involuntarily and causes excessive pain. Pressure, made so as to jam the head of the femur against the acetabulum, almost invariably produces great pain in the hip-joint.

In most cases of commencing hip-joint disease you may gain valuable information as to the situation of the affected structures by pressing with your fingers or by grasping the head of the femur between your fingers and thumb. If there is not marked pain on deep pressure applied *immediately* over the head of the bone, be careful as to giving an opinion regarding the existence of hip-joint disease.

Lameness.—I have before remarked that lameness in the earlier stages of morbus-coxarius may amount simply to weakness, the affected leg giving way as the patient walks. As the disease advances the lameness becomes a more marked feature of the complaint, but it is almost unnecessary to observe that this symptom, unless combined with stiffness in the joint and well-defined local pain on pressure over the head of the femur, can in no case be relied upon as characteristic of hip-disease.

The truth is, during the earlier stages of morbus-coxarius there is sometimes considerable difficulty in forming an opinion regarding the nature of the complaint; you may meet with instances in which a patient is lame with pain about the hip-joint, the limb being slightly flexed, and the muscles surrounding the hip somewhat rigid. There is no marked evidence of disease of the spine; pressure over the vertebræ causes the patient no pain, and yet the case may be one of disease of the spine and not of the hip-joint. In doubtful cases of this description, it is only by carefully watching a child when he is trying to bend forward and pick up something from the floor, that you notice his inability to accomplish such a movement with ease, in consequence of a certain amount of stiffness of his back. In such a case any doubt as to the existence of hip-disease is set at rest, if, when the child's thigh is in a semi-flexed position and he is lying flat on his back, the head of the femur rotates naturally in the acetabulum, and there is no marked pain on deep pressure being made over the head of the femur. It is, however, quite possible that morbus-coxarius and disease of the spine may coexist. Infantile paralysis has been mistaken for hip-disease. This latter affection, however, generally comes on suddenly, commencing with fever. After a few days, if the child attempts to rise or even move in bed, marked loss of power in the affected limb, especially in the extensors of the leg, is noticed; the position of the foot is generally that of equino-varus. In some cases the little patient at the commencement of the attack suffers excessive pain, and cries out the moment his foot, leg, or thigh are touched.

Again, an inflammation of the bursæ or of the soft parts external to the hip-joint may cause symptoms similar to those of morbus-coxarius, as the following notes of a case, taken for me by my dresser, Mr. T. B. Mortimer, demonstrate.

A. S., aged fourteen, was admitted into the Chadwick Ward on December 24th. She was sent into the hospital under the idea that she was suffering from disease of the hip-joint. Last December the patient fell on the ice and injured her right hip. The pain caused by the bruise passed away, but weakness of the hip-joint continued, so that she was apt to trip when walking. About six weeks before coming into hospital she felt considerable pain in the injured hip, and this symptom increased to such an extent as to oblige her to be confined to her bed. On admission into hospital the patient is described as "lying on her left side, her usual position, with her right leg flexed at the hip and knee; the limb is adducted; there was no eversion of the foot. The right and left limb are of the same length. When the patient lies on her back, she is unable to straighten her right leg. On attempting to do so, it causes her very great pain, and the lumbar spine is at once arched forward; the right anterior superior iliac spine is about three-quarters of an inch lower than that of the left side. There is no swelling in Scarpa's triangle, but there is about the trochanter. Great pain is excited by pressure made over the trochanter; there is not so much pain in directly forcing the head of the femur against the acetabulum; the adductor muscles are very tense.

In this case the head of the femur was evidently locked in the acetabulum, and when we attempted to extend the flexed limb the brim of the pelvis was tilted forward; there was stiffness of the hip-joint, and pain on pressure over the trochanter, but there was a marked absence of pain on pressure directly over the head of the femur. There was a swelling beneath the skin covering the trochanter major; this swelling extended backwards towards the gluteal region. When the patient was under the influence of anæsthetics the femur became freely movable on the pelvis. A grooved needle was passed into the skin over the upper and outer part of the thigh, and pus having been detected apparently beneath the tensor vaginæ femoris muscle, a free opening was made into the abscess and a considerable quantity of pus evacuated from it. From this time all the symptoms from which the patient had suffered disappeared, and she left the hospital on February 7th perfectly cured.

SYNOVITIS OF THE HIP-JOINT.

Synovitis of the hip-joint is not unfrequently an acute affection, and, when it continues for some time, leads to disease of the cartilages and bones entering into the formation of the articulation, as well as to abnormal changes in the soft structures surrounding the joint. Among the most common causes of synovitis of the hip-joint I may mention injuries, exposure to cold, and septic poisoning. There can be no doubt that a considerable number of cases of confirmed hip-disease originate in inflammation of the synovial membrane.

The circumstances of synovitis of the hip-joint, in its early stages, are illustrated by the following case:—

T. E., aged eleven, was admitted into the hospital on February 12th: his family history was free from evidence of constitutional disease. The patient's general health had been good up to that time; he had never suffered from rheumatic fever. His mother said, before coming into hospital her son had fallen and sprained his right hip; within a few days of the accident he could not walk without considerable pain in the joint.

On admission into hospital, T. E. was unable to put his right foot to the ground, the limb being flexed and extremely painful. During the early hours of the night the patient was kept awake by the involuntary starting of his leg, which caused him excessive pain. When supported and standing on his left leg the right thigh was flexed, the toes touching the ground; any pressure applied to the trochanter or over the region of the hip-joint caused the boy to cry out with pain; when laid perfectly flat on his back, if an attempt was made to extend the right thigh, the lumbar spine immediately arched forward. The natural furrow in the groin below the crural arch was obliterated, there being evidently considerable distension of the synovial membrane of the right hip-joint, and swelling of the soft tissues external to the articulation.

The thermometer applied to the skin over the inflamed joint indicated a persistent rise of temperature of from one to one and a half degrees as compared with the corresponding spot on the other side of the body.

The limb was fixed to a splint and the extract of belladonna smeared over the groin. After a few days, when the patient could bear pressure, it was employed by means of a pad and india-rubber bandage applied round the joint, iodine liniment being freely painted over the skin of the groin night and morning. The pain gradually subsided, and the patient left the hospital in a month's time cured.

This is a typical example of serous synovitis of the hip-joint, marked by a sudden invasion of the disease, after an accident; the local temperature and the evident distension of the synovial membrane with fluid, the pain increased by the slightest pressure made over the joint or in moving the limb, the flexed position of the thigh and stiffness of the hip-joint, together with the swelling in the region of the articulation commencing so soon after an injury, were all symptoms pointing to inflammation of the synovial membrane of the hip-joint.

Acute serous synovitis, excluding cases of rheumatism, as I have before remarked, most commonly results from an accident; it is characterized by severe pain in the hip-joint, increased by any movement of the limb or the slightest pressure applied over the articulation;

the natural fold in the skin of the groin beneath the crural arch is obliterated in consequence of the distension of the synovial membrane, and more particularly by swelling of the soft tissues external to the joint. There is stiffness in the movements of the joint, the femur being locked in the acetabulum, and the thigh more or less flexed on the body. This position is not only due to the involuntary effort which the patient makes to relax structures pressing upon the inflamed synovial membrane, but whenever this membrane is distended with fluid the limb invariably becomes flexed on the trunk. The temperature of the skin over the inflamed hip-joint in serous synovitis is seldom more than a degree or two higher than that of the corresponding healthy limb.

I believe that disease of the hip commencing after the adult period of life is, in the majority of cases, due to synovitis, or else to granular degeneration of the synovial membrane. Cases of osteo-arthritis are no exception to this rule. Among children, as well as in the case of adults, acute rheumatism is occasionally followed by suppurative changes in one or more of the joints. I have seen several cases in which, after an attack of rheumatic fever, the hip-joint has remained distended with fluid, the patient's general, and the local temperature continuing high, the symptoms pointing to purulent synovitis of the joint. Under these circumstances I have in three instances, in adult patients, aspirated the joint and drawn off several drachms of purulent matter, at the same time washing out the cavity of the abscess, or, in other words, the joint, with a solution of chloride of zinc, four grains to the ounce. In one of these cases it was not necessary to repeat the operation, no further collection of pus occurring; in another the aspirator had to be used a second time, and in one instance three times, but in all three the patients recovered with stiffness but no bony anchylosis of the hip-joint. This stiffness was probably due in one of these cases to the formation of adhesions in or around the joint, for I was subsequently able to break through these adhesions, after which the patient regained full use of the joint.

Among children synovitis is no uncommon cause of morbus-coxarius, and the majority of these cases, if properly treated from an early stage of the disease, may be cured; doubtless they form a large percentage of the instances of hip-joint disease which make comparatively rapid recoveries. The following case, reported for me by Mr. Gubbins, is an illustration of synovitis advancing to active changes in the hip, which, unless successfully treated, would very probably have terminated in osteo-myelitis and necrosis of the head of the femur.

F. H., aged thirteen: this girl's family history is a good one, as far as her health is concerned; she has never had rheumatism or any other illness prior to the affection of the hip from which she now suffers. The disease commenced last August, after a fall from a cart, when she injured her right leg. From the time of the accident she had more or less pain in the right hip-joint; in the month of September the symptoms of hip-disease became so strongly marked that she was sent into the hospital by Mr. F. Nicholls, of Croydon.

On admission, the patient's right thigh was flexed, so that she could only touch the ground with her toes; the slightest movement of the limb caused her intense pain in the hip-joint; she was kept awake at night by the involuntary starting of the limb. The head of the right femur was fixed in the acetabulum, and the synovial membrane was evidently much distended. The temperature of the skin covering the joint varied from 1·5 deg. to 2 deg. above that of the corresponding point on the other side of the body. The patient was at ease so long as her right leg was kept extended and abducted. The fluid contained in the joint was on two occasions drawn off by means of the aspirator. Extension was maintained for two months, and a succession of blisters, and subsequently the actual cautery, were applied with no abatement of the symptoms. The patient's health began to give way, and her temperature to rise during the evening to 100 degrees; the local temperature over the diseased joint was now always two and three degrees above that of the sound side.

On February 2nd, F. H. being under the influence of ether, her right thigh was brought parallel with the other limb, and the right sartorius, tensor vaginæ femoris, and the abductor longus muscles, which had been extremely rigid before anæsthetics were given, were divided subcutaneously. A valvular opening through the skin was made over the trochanter major, and a small-sized hand-drill passed through the trochanter and neck of the bone into the synovial cavity of the hip-joint. A long outside splint was then applied to the limb, and the patient put to bed. From the time of the operation F. H. was free from pain, and in three weeks was up and moving about the wards with a stiff joint. She soon after left the hospital, and has since had no pain or any other symptom of hip-joint disease.

In this case it would appear that synovitis, leading to alterations in the structures in and around the joint, had given rise to bands of adhesion about the articulation; at the same time some acute inflammation of the synovial membrane existed when the patient first came under our treatment. In cases of this description relief is frequently afforded by breaking down the bands of fibrous tissue which have grown round, and confine the action of the joint. It may, however, as in the instance I have referred to, be necessary not only to overcome the symptoms produced by the existence of bands of adhesion about the articulation, but also to resort to measures calculated to relieve the inflammatory action going on in the synovial sac.

Synovitis resulting from exposure to damp and cold sometimes leads to results very similar to those I have described as arising from an injury, for instance.

J. H., aged fourteen: this boy throughout the whole of last winter was exposed to great privation. He had never suffered from acute rheumatism.

During the month of December, after sleeping one intensely cold night in a barn, he awoke in the morning complaining of great pain in the right hip-joint. He was admitted into a workhouse infirmary, and subsequently sent into our wards by Mr. Kelsey, of Red Hill.

On admission, three weeks after the commencement of the disease, we found the right femur fixed in the acetabulum, the thigh being adducted and flexed; the limb was two inches shorter than the left one, the pelvis being tilted upwards on the right side. The lumbar spine was arched forwards; there was considerable swelling beneath Poupart's ligament from distension of the synovial membrane of the hip-joint with fluid. The patient suffered from very great pain in the right knee and hip-joint, aggravated by the slightest movement. He was relieved when the limb was fully extended and adducted; but as treatment of this kind, together with counter-irritation, had been employed before admission into hospital without benefit, and again for a month while in our wards without apparent relief to the symptoms, the patient was placed under the influence of ether, and the sartorius and two of the adductor muscles divided subcutaneously; and the integument over the trochanter having been incised, a hand-drill was passed through the trochanter and neck of the femur into the joint. An outside splint was applied to the limb for a week. From the time of the operation the pain in the hip-joint and the knee almost entirely disappeared; no subsequent treatment was employed, and in a month's time the boy was able to get up and move about the ward without pain. He subsequently left the hospital with a stiff hip-joint, but otherwise apparently free from disease.

There can be no question that spasm of the muscles in cases of this kind may be overcome by extension effected through a weight and pulley, a means of treatment which cannot be too highly recommended, but after treatment of this description has had a fair trial, say for two months, in conjunction with counter-irritation first with linimentum iodi, and it may be subsequently by the actual cautery, and has failed to relieve the symptoms, it seems desirable to divide the affected muscles in order to overcome their abnormal rigidity and its consequences. The histories of the patients above given illustrate the fact that treatment of this kind, whatever its ultimate value may prove to be, is attended with less risk than some practitioners might suppose to be the case. But it is distinctly and clearly to be understood that an operation of this kind should never be undertaken until an effort has been made to overcome the disease by rest, counter-irritation, and pressure exercised over the joint. I would only remark, however, that treatment of this description should not be persisted in, if after a reasonable period it fails to relieve the symptoms; it is then better to open the synovial membrane through a passage made into the bone, such as I have described, dividing also some of the rigid muscles rather than allow the patient to rest on until he passes into a most serious form of disease, the cartilages, ligaments, and the head and neck of the femur ultimately being destroyed by the abnormal action commencing in serous inflammation of the synovial membrane.

I believe that, in some cases of serous or muco-purulent synovitis of the hip-joint, it is advantageous to draw off the fluid distending the synovial membrane by means of the aspirator. The operation may be repeated three or four times, but in my hands aspiration has not unfrequently failed to relieve symptoms of synovitis of the hip-joint, and it is in consequence of this fact that I prefer to open the joint in the manner I have described.

Pressure subsequently applied by means of cotton wool and an india-rubber bandage, with rest insured by a long splint, are most important adjuncts in our treatment.

And, lastly, counter-irritation must be systematically and persistently used.

Epiphysitis of Head of Femur (Hip-Joint).

It is hardly necessary for me to remind you that until a child is thirteen or fourteeen years of age, ossification does not commence in the Y-shaped piece of cartilage which separates the three portions of bone entering into the formation of the acetabulum;

the neck of the femur is not united to the head by osseous tissue until after puberty, and lastly, the line of junction between the head and neck of this bone is enclosed in the capsule of the hip-joint, so that disease commencing at this line and spreading outwards, does not, as a rule, give rise to acute periostitis of the shaft of the femur as in the case of epiphysitis of the upper end of the tibia, but to suppurative synovitis of the hip-joint.

In consequence of the peculiar conformation of the upper extremity of the femur, the tender, vascular and growing tissues between the head and neck of the bone are very liable to be contused, the weight of the body being constantly thrown upon this line of ossification: and abnormal action once established in this situation, the part is placed under very unfavourable circumstances for recovery, being subjected to constant movement and to considerable pressure. In this way chronic osteo-myelitis is established, and the diseased action extending outwards, synovitis, not unfrequently of a purulent character, occurs. Beyond this, inflammation and degeneration of the tissues at the line of ossification between the head and neck of the femur necessarily loosen the connection of these parts to one another; at the same time the tendency of the powerful muscles attached to the trochanters is to pull the upper end of the shaft of the bone backwards on the dorsum ilii, leaving the head of the femur in the acetabulum. Under these circumstances there is actual shortening of the diseased as compared with the sound limb; the upper end of the femur on the diseased side will probably be drawn close up to the anterior superior spinous process of the ilium, and a line from this process to the prominent part of the tuberosity of the ischium will cross the upper end of the femur in place of falling on the superior border of its trochanter.

You may meet with cases of morbus-coxarius which have perhaps been going on for some months, and in which there is shortening of the limb and separation of the head from the neck of the bone; well-applied extension, by means of a weight and pulley, may overcome this shortening; and, according to Prof. C. Hueter, under these circumstances it is possible, by bringing the neck of the femur into apposition with its head, that osseous union may occur between them. I have never met with an instance of the kind; on the contrary, the head of the bone usually becomes necrosed, and the abscesses it occasions will not heal until it is removed. A case of this description was sent into the hospital by my friend Dr. Lownds, of Egham.

R. R. P., aged thirteen, had been suffering from symptoms of morbus-coxarius for two years. The disease commenced after an attack of typhoid fever; while convalescent she was seized with pain in the right hip. In the course of a month an abscess burst in the upper part of the thigh; but disease of the hip-joint was not suspected until the right leg was found to be shorter than the left, and since then she had never been able to walk. Under these circumstances her parents consulted Dr. Lownds. On admission into hospital the patient was in good health notwithstanding the existence of several sinuses around the right hip, from which a considerable quantity of matter constantly flowed.

The upper end of the right femur was drawn upwards on the back of the ilium; the right foot could not be brought within an inch and a half of the ground. On making forcible extension of the right thigh crepitation could be felt in the hip-joint. The patient having been placed under the influence of ether, one of the sinuses on the upper part of her thigh was laid open; through this a finger could be inserted towards the acetabulum, where a large piece of loose bone was detected: it was removed, and proved to be almost the entire head of the femur.

The sinuses healed, and I saw the patient eighteen months after the operation; she was then able to walk without apparent lameness, aided by a boot with a thick cork sole. The upper extremity of the femur had made a false joint for itself, allowing of considerable movement of the limb.

The question arises as to the diagnosis of epiphysitis of the head of the femur. Excluding cases of septic poisoning, as a rule, acute inflammation and rapid suppuration in the hip-joint, before the adult period of life, is due to epiphysitis—it may be after a fall or an injury. Although perhaps the patient is too young to give a description of the accident, he shows unmistakable signs of pain in or about the hip-joint; he becomes very feverish, and in the course of a week or ten days a swelling appears in the region of the joint. If the local temperature over this swelling is observed it will be found at least three degrees higher than the corresponding point on the sound side; a comparison of this kind is necessary, because the temperature of the patient's body indicates the presence of considerable pyrexia. The child keeps his thigh on the affected side flexed on the abdomen, and the slightest movement of the limb, or effort to extend it, evidently causes extreme pain. In the course of three weeks or a month the skin over the groin, and probably also in the gluteal region, becomes tense and swollen, and fluctuation can generally be detected in one or both of these localities. Unless the matter is evacuated, the integument gives way and a considerable quantity of pus exudes from the opening. Under these circumstances the surgeon, in all probability, will be able to pass his finger through the abscess down to the neck of the femur, and on rotating the child's thigh he will probably find that the upper portion of the shaft of the bone moves independently of its head; crepitation may not unfrequently be felt at the same time. Subsequently as the swelling subsides in and around the joint, the upper extremity of the femur is drawn on to the dorsum ilii by muscular action, producing considerable shortening of the affected limb.

In consequence of the extreme pain which the patient suffers, it is almost impossible, in the earlier stages of the disease, to ascertain if the head of the femur is locked in the acetabulum; if, however, it is possible to make such an examination, be careful not to mistake free movement of the trochanter and neck of the femur on the epiphysis for the movement of the head of the bone in the acetabulum.

Cases of epiphysitis, such as I have described, not unfrequently recover in the course of time; the sinuses cease to discharge, a false joint is formed between the upper end of the femur and the ilium, and the patient gains a fairly useful limb, although it is shorter than the sound one. The younger the child is the less chance there seems to be of the head of the bone becoming necrosed and acting as a foreign body in the manner I have described in the case of R. R. P.

In the treatment of epiphysitis of the hip-joint it is important to ascertain the nature of the disease as soon as possible, and in order to do this, if the symptoms point to suppuration of the joint, it is advisable to pass a grooved needle through the integument into the articulation. Should matter be found in or about the head of the femur, a free opening must be made into the joint—if possible this opening should be in a dependent position so as to prevent the accumulation of pus about the hip. To effect this object, as your patient will be almost constantly on his back, an incision may be made in the gluteal region, at the lower border of the gluteus-maximus, rather internal to the median line of the thigh, so that a Thomas' splint may be worn by the patient without in any way interfering with the free escape of matter through the opening you have made into the joint. A splint of this kind having been applied, the child should be laid on a Mackintosh sheet with some marine tow over the passage through which the discharges flow: beyond this no bandages should be applied, otherwise the pus may be prevented from escaping through the wound, which must be kept open by means of a short drainage tube.

I should not be disposed, from my present experience of these cases, to attempt extension of the limb by means of a weight and pulley, in the hope of bringing the head and neck of the femur in apposition in order that they may become reunited; nor do I think it desirable, even if it were possible, to keep up extension sufficient to prevent shortening of the diseased limb. Under these circumstances it seems to me better to retain the thigh and the pelvis as nearly as possible in their natural position by means of a Thomas' splint, and so allow the upper portion of the femur to form a false joint for itself on the dorsum ilii.

When lecturing upon the subject of epiphysitis, I gave an account of suppurative inflammation of the hip-joint connected with this affection (p. 79), but there is every reason to suppose that a chronic form of disease may occur at the line of junction between the diaphysis and head of the femur, which, nevertheless, gradually spreads outwards and involves the synovial membrane. For instance, we know that in some rare cases of epiphysitis, the result of inherited syphilis, changes occur at this line, the patient suffering from well-marked symptoms, which, in conjunction with the swelling about the hip-joint, indicate in an unmistakable manner the nature of the affection. Suppuration, however, is by no means the most common result of syphilitic epiphysitis, and although cases have been recorded, I have not met with an instance of this kind in connection with the hip-joint. Nevertheless, I do not question the fact that a considerable number of instances of morbus-coxarius which we meet with, especially among infants and very young children, have commenced in abnormal changes in the soft structures between the neck and head of the femur. Chronic osteo-myelitis of the soft structures contained in the neighbouring cancellated tissue supervenes, ending in necrosis of the bone and the destruction of the joint.

CHRONIC OSTEO-MYELITIS OF THE HEAD AND NECK OF THE FEMUR.

Surgeons who have had experience in our London or Provincial hospitals, are aware how frequently cases of morbus-coxarius occur in connection with disease in the soft structures contained within the head and neck of the femur. I do not propose referring to instances of hip-disease referable to an abnormal condition of the bones forming the acetabulum, because

I know of no symptoms by which we can determine if the disease has commenced, or to what extent it exists, in this locality independently of the head and neck of the femur.

It is unnecessary to occupy your time by reiterating the evidence already given regarding the scrofulous nature of a considerable number of the cases of osteo-myelitis which we meet with (p. 87); but I may remark that hip-disease depending on this cause is more frequent among children than in adults, because their bones are soft and vascular, and the head and neck of the femur very liable to be contused. Disease once excited in the medulla of this locality gets but little rest, and among scrofulous subjects has a tendency towards degeneration rather than to reparation.

The symptoms of the early stages of chronic osteomyelitis of the head and neck of the femur are, as a rule, ill-defined. A child, perhaps, complains of weakness in one leg; it may be that the limb only gives way under him after walking for some distance or in running. He has obscure pain about the hip-joint. This weakness of the leg is transitory, for weeks it may hardly be referred to, then for a few days the child is incapacitated from taking any active exercise in consequence of his liability to trip or fall. Symptoms of this kind occurring among girls are not unfrequently assigned to nervousness or hysteria, and among younger children to a strain. After a time the fault in walking develops itself into actual lameness, and then the child begins to complain of pain in the knee-joint or along the inner side of the thigh rather than in the hip. I may refer to the following case as an instance in point.

E. N., aged fourteen, was sent up into the wards from the out-patient department on May 21st. He is a plump, healthy-looking lad, the youngest of four children. One of his aunts and his grandfather died of consumption. The boy's mother says that about a month ago she noticed he limped a little for four or five days, but he complained of no pain; and as the lameness passed off she took no notice of it until the symptoms returned within the last few days.

Our patient was laid naked upon a form; we then found that his right thigh was slightly flexed on the trunk; in this position his lumbar spine rested upon the surface on which he was reclining. Leaving this thigh flexed, we could freely extend and flex the other limb without there being any evidence of stiffness of the hip-joint. Directly, however, we attempted fully to extend the right leg, so that the back of his knee rested upon the form on which he lay, his pelvis was tilted forwards and his lumbar spine became considerably arched. When the right thigh was semi-flexed the slightest attempt to rotate the femur was attended with evidence of stiffness of the hip-joint. All movement of this kind caused the patient considerable pain, and when pressure was made over the head of the femur the child cried out with pain. Having placed the patient under the influence of ether, the stiffness of the joint entirely disappeared, and the right thigh could be fully flexed without the lumbar spine arching forwards. On the most careful examination we failed in detecting the presence of fluid in the right hip-joint; there was no rise of temperature over the right as compared with the left side. These symptoms, combined with the history of the case, led me to believe that this was an instance of tubercular osteo-myelitis of the head of the right femur. I urged the lad's mother, without effect, to leave her boy in the hospital.

We heard nothing more of the patient for seven months; in the meantime he had been in a "children's hospital" for three, and in a general hospital for two months. He was now suffering from an advanced stage of hip-joint disease; was extremely emaciated and very pale, but his water contained no albumen, nor was there any evidence of lardaceous disease. His right thigh was flexed and abducted; there were several sinuses in the upper part of the limb from which a large quantity of pus was constantly discharging; on moving the leg, crepitation could be felt in the hip-joint.

I divided several of the rigid muscles round the joint, so as, without using much force, to bring the flexed limb down upon a Thomas' splint. I then made an opening into the joint through the integument at the lower and inner part of the fold of the gluteus maximus; a large-sized drainage tube was passed through the incision and out at one of the sinuses in the anterior part of the thigh. The limb was then secured to the splint, and the dependent opening which had been made was left free, so that the matter in and about the joint might drain away without the slightest obstruction. The drainage tube was kept in its position for a fortnight, and then withdrawn; the red lotion was frequently syringed through the passage which had been kept open by the tube. In the course of a month's time we were able to remove the child to the seaside, where he remained for six weeks, and returned to the hospital greatly improved in health. The Thomas' splint was continued for another month, and then, as there was very little discharge from the openings about the hip-joint, I was able to apply a plaster of Paris bandage, so as to enclose the patient's thigh and pelvis. He was sent to his home, and allowed to move about on crutches; subsequently the bandages were removed, and the boy is now able to walk with a high-heeled shoe. Anchylosis of the hip-joint exists, but he is able to get about with very little inconvenience.

With reference to this history, I would remark that it demonstrates how much may sometimes be done for children suffering from advanced hip-joint disease, though I would not for an instant have you suppose that the majority of cases of this kind will respond to treatment in the way that this boy did. Not unfrequently, in spite of rest, drainage, and every other measure we may adopt, the patient gradually passes from bad to worse, and it becomes necessary to resort either to resection of the hip-joint or amputation of the limb in order to save life (p. 442).

Although I believe that drainage tubes are of great advantage in these cases, nevertheless they are not without their danger, as the following history demonstrates. Another lesson we may learn from its details is, that in spite of the unfavourable symptoms under which the patient laboured, after amputation the condition of the head and neck of his femur were such as to prove that had we been able to continue our treatment by drainage and rest, there was no reason why the issue of the case should not have been similar to the one which I have just related.

A. S., aged six. This boy was sent up from the country. His father had been under treatment in the Brompton Hospital for consumption. Some time since our patient had a fall, bruising the outer part of his right hip and side; he recovered from this, and was able to run about again, though still complaining of pain in the right hip. After two months the pain had increased so much as to make him quite lame, and under these circumstances he was taken for treatment to a cottage hospital. The disease, however, after three months' rest and care, gradually got worse, and under these circumstances he was sent into the Westminster Hospital. On admission the child was suffering from intense pain in and about the right knee, increased by the slightest movement or pressure over the thigh. The limb was flexed and adducted and fixed on the pelvis; there were sinuses both before and behind the trochanter major leading to the joint; crepitation could be felt about the head and neck of the femur. Considering the length of time the child had been under careful treatment, first by extension, and then by the application of a Thomas' splint, it seemed desirable to remove the dead bone, should there be any, which was keeping up irritation, and then by drainage tubes to prevent the collection of matter in and about the acetabulum. I therefore made an incision which would enable me to excise the head of the bone, if necessary. On passing my finger through this opening, I found a considerable portion of dead carious bone loose in the acetabulum: this was readily removed, and an opening having been made from the joint through the integument at the inner and back part of the thigh, a drainage tube was passed to the inner side and the front of the femur, and so through one of the sinuses near the groin. A Thomas' splint was then applied. Everything appeared to be doing well until the twelfth day after the operation, when, as the nurse was dressing the wound, sudden hæmorrhage occurred. My dresser, Mr. Gubbins, happened to be in the ward at the time, and immediately applied pressure over the common femoral artery with the effect of stopping the hæmorrhage until I arrived. As there could be little doubt that the deep femoral artery had given way, and considering the long-continuance and the extensive nature of the disease, it seemed advisable to amputate the limb at the hip-joint without delay. The operation was therefore performed at once, and the child made a rapid recovery, being able to leave the hospital in three weeks' time, with a very good stump.

After amputation, we found that the drainage tube had passed between the deep femoral artery and the femur, causing ulceration of the vessel by pressure. From this preparation you may see that although the head and neck of the femur have in part disappeared from the effects of disease, nevertheless that portion of the bone which is left contains a considerable quantity of medullary structure, and beyond the neck of the bone the femur is healthy; so that there was no reason why the patient should not have recovered the use of his limb, the more so as there was no lardaceous disease, the existence of which would have rendered it imperative for us to have amputated at the hip-joint, for the only hope we have of preventing the advance of lardaceous disease under circumstances such as these is to take away the diseased limb, and with it the bone which is the source of irritation and suppuration. However far advanced the lardaceous disease may be, we need never despair of its ultimate cure, provided we can remove the cause of the discharge.

If asked what, in my opinion, is the primary and chief point to attend to in the treatment of the early stages of hip-disease commencing in osteo-myelitis of the head of the femur, that is, before sinuses have formed in connection with the joint, I should reply good food and sea air, or rather residence at the seaside. Pure air, food, and light, as I have insisted over and over again, are essential to the successful treatment of these cases.

Rest is very necessary, and is enforced by the pain caused on moving the limb; but, as a means of cure, I think that it has been too much insisted on of late years in instances of tuberculous inflammation of the head of the femur; in these cases I believe the best method of affording rest to the diseased parts is by means of Thomas' splint. Extension, by a weight and pulley, is doubtless of great service in many cases of this form of disease, but, according to my present experience, may be often dispensed with if the rigid muscles are divided subcutaneously.

Counter-irritation is as necessary in chronic osteomyelitis as it is in synovitis of the hip-joint.

When lecturing on tuberculous affections of bone (p. 116) I gave the reasons which have induced me to adopt the practice of boring into the cancellated tissues of bones affected with this form of inflammation, and with reference to cases of chronic osteomyelitis of the head of the femur I am able to speak favourably of the results of this plan of treatment. My idea is, that by breaking down the soft and vascular medulla which exists in the head and neck of the diseased bone we may excite in the part a different action, and often a more healthy one, than that which exists, in somewhat the same way as we cure a case of lupus by breaking down the soft tissues which cover the diseased surface.

In instances of tuberculous disease of the head of the femur, so soon as the symptoms are clearly defined, and before the period when abscesses have formed in or about the joint, I am in the habit of dividing rigid muscles subcutaneously, and boring through the trochanter into the head and neck of the bone, the limb subsequently being secured on a Thomas' splint, for which, in the course of ten days or a fortnight, a plaster of Paris bandage is substituted, and the patient sent to a convalescent hospital, preference being given to one at the seaside.

Among the children of the well-to-do classes of society, cases of hip-joint disease, depending on chronic osteo-myelitis, provided they are brought under treatment in its early stages, usually get well, because we can secure these patients sea-air, proper food, and sunlight; but we should warn the friends that many months, and it may be years, of anxious care must be bestowed on the patient. Our views regarding the future of any case must also depend on the family history. The principal point to be determined is the existence of a scrofulous tendency; information regarding this point is frequently more reliable when communicated by the general practitioner attending the family than from the patient's relatives.

The cause of the disease and the symptoms attending its onset, together with the general condition of the patient's health, are important elements to be considered when forming our prognosis in cases of morbus-coxarius. After an injury, such as a fall, excessive pain occurring in the hip-joint within a fortnight of the accident, together with symptoms of distension of the synovial membrane of the joint, is probably due either to acute epiphysitis or to synovitis. The former disease does not often occur among children over five years of age, and is attended with considerable constitutional disturbance followed by indications of suppuration of the joint. Acute traumatic synovitis generally sets in within a few days of an accident, is attended with much pain, increased by pressure over the joint, or the slightest movement of the limb, the thigh being flexed and the head of the femur locked in the acetabulum; there is seldom much fever, no evidence of rigors, and the local temperature is not more than two or three degrees higher than that of the corresponding spot of the other limb; the capsule of the joint is always distended with fluid. If in doubt in a case of this kind, it is advisable to draw off the fluid contained in the synovial membrane. Morbus-coxarius commencing with no very definite symptoms, the patient only complaining of lameness and slight pain about the region of the hip-joint, and if, on examination, we find the head of the femur does not rotate freely on the pelvis, and there is pain on deep pressure being made over the head of the bone, the case is probably one of tubercular osteomyelitis. This idea is confirmed if the patient is pallid, in bad health, and a member of a scrofulous family.

Acute epiphysitis will seldom be cured without considerable shortening of the limb, and in all such cases the patient's life is in great danger from suppurative osteo-myelitis and pyæmia, too often terminating suddenly in death. Synovitis in its early stages, before it has produced disease of the bone or irreparable changes in or about the joint, is generally capable of being cured, but the motion of the articulation is frequently impeded by bands of connective tissue restricting its movements; when these bands are broken down the use of the joint may be completely restored. Chronic inflammation of the medulla, in spite of the most careful treatment, will sometimes advance to the destruction of the bone, unless we can overcome the constitutional defects which prevent reparative action from taking place in the diseased structures. A slight experience, however, of hip-disease is sufficient to convince us that there are a considerable number of cases belonging to this latter class, especially among poor people. These patients, in spite of any treatment we may adopt, do not improve; on the contrary, they get worse month by month, abscesses form in connection with the diseased bone, and the question arises as to the necessity of an amputation at the hip or of resection of the head of the femur. If you have had the opportunity of watching a case of morbus-coxarius from its early stages, and have failed to arrest the progress of the disease, abscesses having commenced to form, not simply outside the joint, but in connection with diseased bone, you cannot possibly shirk this question.

There are many cases of hip-joint disease in which extensive abscesses have formed prior to our seeing the patient, and some few in which the collection of pus has taken place exterior to the joint. Under these circumstances, as I have already remarked, you must endeavour to overcome the disease by means of free incisions, efficient drainage, rest, fresh air, and light, but these means failing, the question of amputation or resection presents itself to your mind. In my opinion, cases of morbus-coxarius which have resisted all our efforts to relieve the symptoms from which the patient suffers, are, as a rule, better treated by amputation at the hip than by resection of the diseased bone, because, in the majority of these cases, the bones of the pelvis are implicated, and the presence of albumen in the urine and enlargement of the liver and spleen indicate too plainly the existence of lardaceous disease of these organs; our only hope of overcoming this latter condition is to remove the source of irritation and suppuration. I have seen cases of advanced lardaceous disease recover after amputation of the limb, whereas resection, which, in children over six years of age, is frequently followed by a continuance of the suppuration for a considerable time (especially when the acetabulum is involved in the disease), would almost certainly have terminated fatally.

On the other hand, suppose a young child afflicted with disease of the hip comes under your care, and abscesses connected with the joint have formed, if, in spite of careful treatment, including efficient drainage and rest, the patient continues to grow worse, crepitation being detected in the hip-joint, but there is no evidence of lardaceous disease, my advice is, without further delay excise the head and neck of the bone, leaving the greater trochanter of the femur. Excision of the diseased head and neck of the bone is not so fatal an operation at the present day as it was formerly, if performed on *children*, and it not unfrequently leads to favourable results, provided the operation is not delayed too long. In forming an opinion as to the necessity that exists for excising the head of the femur in any particular case, the duration of the malady is not the only point we have to consider, but rather, if the patient under our care is one of those cases of hip-disease which, in spite of all we can do, persistently get worse. Having satisfied ourselves that such is the case, if the patient is a child, and otherwise in a fair state of health, excision of the head of the bone should be effected as soon as possible. You may ask how long are you to try palliative treatment in a case of this description? It is impossible to fix any definite time; each case must be judged on its own merits. I do not remember having met with an instance of morbus-coxarius in which I have excised the head of the bone within five or six months' time from the commencement of the disease.

Among adults, morbus-coxarius is comparatively rare, and excision of the hip-joint, supposing all other methods of treatment to have failed to relieve the symptoms, is less satisfactory than an amputation. In fact, the younger the patient the better the success following excision of the joint, but up to twelve years of age, this operation, if performed under antiseptic principles, is not unfrequently successful; every year beyond the age of twelve adds to the danger attending excision of the head of the femur, and if the patient survives, the ultimate result of this proceeding is less satisfactory.

Mr. T. Holmes, in his address in surgery at the last meeting of the British Medical Association, at Cambridge, gives us the following information regarding the results of excision of the hip performed in several large hospitals during the five years ending 1878.

King's College.—All the operations here seem to have been performed for confirmed caries.

St. Bartholomew's.—This operation finds little favour as a rule, and is seldom resorted to as long as there appears a possibility of recovery by rest, etc. It is resorted to in cases of long-continued suppuration likely to end fatally.

Guy's.—I am under the impression that in this hospital the cases of excision of the hip are chiefly in the practice of one or two of the surgeons, and that the operation is used at an earlier stage.

St. George's.—Here the operation is a very rare one, being reserved for cases obviously incurable otherwise.

St. Thomas's.—Here, I believe, the operation is practised much more freely, and in earlier conditions of disease.

Manchester.—Here, again, the operation seems to be regarded with little favour, and is used chiefly as a kind of adjunct to the natural cure—*i.e.*, to afford a free opening, and remove great part of the diseased bone, even when the whole disease cannot be extirpated. Consequently the convalescence is very long. Incision and drainage of the joint is well thought of.

LEEDS.—At this hospital the operation has been tried in various ways; at one time, as a last resort, in cases where death was otherwise inevitable; again at an earlier stage of the disease; and again in contrast to other plans of treatment—*i.e.*, expectancy, early excision, late excision, and amputation in advanced cases are being contrasted. Hitherto the experience of the operation has not been favourable.

LIVERPOOL.—The excision of the hip is very rarely practised.

DUBLIN.—In Dublin also the operation is little used. One surgeon—Dr. Barton—reports seven cases, with good results on the whole. Another professor—Bennett—is endeavouring to apply it to the cure of cases in the adult. It seems only employed in cases otherwise hopeless.

Hospital.	No. of Cases.	Limit of Age.	Result.			General Observations.
			Died.	Failed.	Succeeded.	
King's College	16	4 to 40	3	5?	8	In 5. sinuses were still open when they left the hospital. The patients, as a rule, were much relieved by the operation. A patient aged 40 died; one aged 39 recovered.
St. Barthol...	6	5 to 20	1	—	5?	The information as to completeness of cure is defective.
Guy's	64	—	8	8	48	
St. George's..	2	—	1	—	1	
St. Thomas's..	76	1 over 50	17	34	25	Many of those classed as "failed" very probably ultimately recovered with useful limbs; but there is no distinct information. The patient aged 51 died.
Manchester ..	14	—	3	2	9	In the 2 classed as "failed" amputation was performed; in one successfully; the other is one of the 3 who died.
Leeds	37	1 aged 48	8	8	21	The 8 cases of failure consist of 3 in whom amputation was performed, and 5 classed as "not improved." I believe the results in the 3 who suffered amputation are not noted. The patient aged 40 died.
	215	—	41	57	117	

Mr. Holmes remarks:—"I would sum up what I have to say about excision of the hip in a very few words, by the simple statement that it ought to be very rarely indeed required, if the disease were treated properly at its commencement. In cases seen at an advanced stage of the disease, it is chiefly when sequestra exist that the operation is *necessary*, though it may be *advisable* as a means of shortening the treatment in other cases also, when the patient cannot obtain the prolonged surgical care which is essential to natural recovery."

DISEASES OF THE KNEE-JOINT.

Having so frequently referred to diseases of the knee-joint in the preceding pages, I have not much to add with reference to affections of this articulation. For instance, in my lecture on osteo-arthritis and tuberculous inflammation of bone, I related cases in which the lower end of the femur and the upper extremity of the tibia were implicated, the knee-joint ultimately being involved in the diseased action (p. 89). Again, when discussing affections of the synovial membrane, I referred to examples of various forms of synovitis of the knee-joint (p. 339). I described serous synovitis of the knee as arising from the effusion of blood into the joint, resulting from rupture of some of the vessels after an injury, or from the effects of inflammation consequent on rheumatism, septicæmia, and so on. Whatever the source of the fluid within the joint, its presence may readily be ascertained, because the distended synovial sac bulges outwards both above and on either side of the patella, and fluctuation may be detected in this situation.

From experiments made after death it is found, that we can inject a greater quantity of fluid into the knee-joint when it is semi-flexed than in any other position of the limb; but while the joint is fully distended, if the surrounding muscles be divided, it is possible to drive more fluid into it, showing that the action of the muscles limit the capacity of the synovial membrane to contain fluid, and therefore, as in the hip-joint, the pressure of these muscles round the articulation play an important part in the symptoms presented by disease of the knee. We see this exemplified every day in the wards, the semi-flexed position of the leg on the thigh being characteristic of acute synovitis of the knee, and any effort to extend the limb is attended with great increase of pain, in consequence of the pressure which the muscles then exercise upon the inflamed joint.

I have before insisted on the fact that synovitis, to be treated effectually, should be treated at the commencement of the disease. It is often in the comparatively painless stages of this affection, which in some cases exists perhaps for a week or so—it may be after an injury and before active congestion and effusion into the joint have occurred—that cold, in the form of ice-bags applied over the articulation, is so effective in reducing the inflammatory action. Cold applications have not the same salutary power in synovitis of the hip or other joints covered in with thick layers of soft tissues; but in synovitis of the knee, cold, constantly applied, not only restrains the effusion of serum into the joint from injured vessels, but it also directly controls inflammatory action, and is unquestionably a therapeutic agent of considerable value in the earlier stages of synovitis of the knee. Subsequently belladonna smeared over the joint, which is then to be surrounded by cotton wool and an elastic bandage, together with rest, are important means in the treatment of these cases. If neglected, a patient suffering from what may appear to be a comparatively slight attack of synovitis, after the acute symptoms have passed away, not unfrequently finds his power of locomotion seriously impaired, bands of connective tissue having formed external to the articulation, and bound the contiguous bones together. In stretching these bands of adhesion when the patient attempts to move about, a considerable amount of pain and fresh attacks of synovitis are produced. Beyond this, among persons predisposed to granular degeneration of the synovial membrane, this disease may be brought into activity by neglecting to subdue an attack of synovitis in its early stages.

Muco-purulent synovitis, so far as cases of the kind come under the surgeon's treatment, are, as a rule, the result of an injury, of acute rheumatism, or of septic toxæmia: perforating wounds of the joint are comparatively rarely met with. Gonorrhœal rheumatism and inflammation of joints resulting from the absorption of putrid matter from bone surrounding carious teeth are of common occurrence; gleet, depending perhaps on stricture of the urethra, must be cured before we can expect to get rid of synovitis referable to the absorption of matter into the circulation from the diseased mucous membrane, and the same remark applies to other sources of purulent infection.

In consequence of the synovial membrane of the knee being situated immediately beneath the skin, changes occurring in the joint are well marked by the thermometer; a continued rise of temperature (above that of the corresponding healthy side of the body), when over four degrees, indicates a muco-purulent inflammation of the synovial membrane. A persistent temperature of seven degrees would lead us to suspect an abscess in or about the joint. In taking the local temperature instruments made specially for the purpose must be employed. Of these thermometers, I rely with confidence upon the instrument devised by Dr. Dupré; the flat bulb of his thermometer may be retained against the skin by means of a pad of cotton wool, the same proceeding being followed in taking the temperature of both limbs. Be careful that the joints are under similar conditions during your examination. For instance, if a patient has been wearing an elastic bandage over one knee, do not proceed to apply your thermometer to the skin immediately after its removal, for if you do, you will find its temperature considerably higher than that of the other limb, which has had no elastic bandage covering it. Matters of this kind must be carefully attended to in order that we may ensure reliable results, the rule being to have the diseased side under precisely the same external conditions as the part it is to be compared with, before taking their relative local temperature. With care in the method of examination the temperatures of the knee, ankle, wrist, and elbow joints, afford us valuable information regarding the progress of the disease which may be going on in them. But if in doubt in any particular case, we may satisfy ourselves on the subject by running the needle of an aspirator into the joint, and drawing off the fluid it contains.

The object of determining the nature or, perhaps, to speak more accurately, the degree of inflammatory action in a joint is to obtain guidance as to our treatment and prognosis. Cases of muco-purulent synovitis are of a much graver character than those of the serous form of disease. Indeed, the former condition cannot exist for any length of time without leading to permanent changes in the structures composing the articulation, a thickened synovial membrane and bands of new growth outside the capsule being the most frequent changes observed after severe and long-continued muco-purulent synovitis: complete destruction of the articulation is no uncommon result of this form of disease.

You will not often see cases of acute suppurative synovitis of the knee among adults. It occasionally, however, follows rheumatic affections and septic poisoning. Among infants suppurative action in the joint is, for the most part, the result of epiphysitis, but whatever may be its cause or the age of the patient, when matter has formed in the knee the sooner an opening is made into the joint to allow the pus to escape externally the better.

Acute suppurative inflammation of the knee resulting from a punctured wound is unquestionably a serious accident; nevertheless, if putrefying matter is prevented from collecting in or around the joint, it is quite possible not only to save the limb, but the joint also. If suppuration occurs in an injured knee, the best chance we have of saving it is by free incision and drainage, rest, and ice applied during the more acute stages of the inflammatory process. If, however, pyæmia supervenes in a case of this kind, the last hope of saving the patient's life lies in amputating the limb above the joint as soon as practicable.

Punctured wounds of the knee are by no means necessarily followed by suppuration, or even by acute inflammation, provided the wound, soon after the injury has been inflicted, has been carefully washed and syringed out (with a weak solution of carbolic acid), so as to remove any foreign substances; the patient's thigh and leg being kept absolutely at rest by means of a splint, under these circumstances it is quite possible, by means of the persistent application of ice, to prevent the access of inflammation. I have known cases of a punctured wound of the knee treated in this way, the mouth of the wound being covered by a fold of lint soaked in carbolic oil, which have done remarkably well, the patients having recovered with perfect movement of the joint.

We frequently see, especially in hospital practice, cases of fibrous anchylosis of the knee resulting from disease, the leg being bent at such an angle on the thigh as to render it impossible for the patient to bring his foot to the ground. If we can still move the tibia on the femur, showing that bony union has not taken place, and supposing all evidence of active disease has subsided, it is quite possible that forcible extension of the limb, when the patient is under the influence of chloroform, may enable us to straighten the leg. In most cases, however, it is necessary to divide the contracted tendons in the popliteal space before we can extend the leg with ease on the thigh; and in not a few instances, as I have already explained (p. 191), we may have to cut through the anterior part of the condyles of the femur, and force the detached portion of the bone upwards on the femur before we can fully extend the tibia.

There can be no question as to the fact that cases, such as those I have referred to, are most satisfactorily treated when the diseased action in the knee-joint has subsided; but we constantly meet with cases of synovitis, frequently succeeding prolonged rheumatism, in which the legs are slightly flexed on the thigh, there is considerable pain in the joint, and the patient has rheumatic pain in various other limbs. Under these conditions, it is useless to wait until the affected knees have become free from pain, for if we do, it is quite possible that the joint may have become disorganized in the meantime. I strongly advise that in cases of this description we should not wait until all symptoms of synovitis have subsided, but at once extend the leg on the thigh, and keep it in that position on a splint. An elastic bandage, that is, pressure over the joint, immediately after the limb has been extended, is very useful, and subsequently friction, counter-irritation, and passive movement of the joint must be employed.

I am not disinclined, even in more acute cases, to resort to treatment such as I have described. For instance, my dresser, Mr. H. J. Walsh, reports that E. C., aged nineteen, was admitted into the Chadwick ward on July 21st. She had been under Dr. Allchin's care, suffering from acute rheumatism of some ten weeks' standing. When sent into my ward, the left leg was bent at a right angle on the thigh, the joint was rigid, its temperature constantly above 105°, it was intensely painful, and the involuntary starting of the limb at night kept the patient in terrible pain. E. C. was very emaciated and out of health.

Soon after this girl came under my care, I drew off two ounces of muco-purulent fluid from the joint; the patient being under the influence of ether I could move the joint to some extent, but deemed it better to divide some of the contracted tendons in the popliteal region, and without any great force, I then extended the leg on the thigh. A long splint was fixed behind the limb, and a pad of cotton wool and elastic bandage round the joint. The patient experienced a very great relief from this proceeding. Pressure was kept up over the joint for some time, and subsequently a plaster of Paris bandage was applied and worn until the month of October, when the patient could walk about and perform her duties as a housemaid, the movements of the knee-joint being limited, but absolutely free from pain, the left leg being of the same length as the right one.

In cases of bony anchylosis, the tibia and femur having grown together in consequence of disease of the knee joint, an operation such as that performed as far back as 1827 by Mr. Barton, of Philadelphia, may be undertaken: he excised a wedge-shaped portion of the lower end of the anterior part of the femur, so as to enable him to bring the bent leg forward and to extend it on the thigh. Measures such as these, together with division of the ham-string tendon, are better adapted to overcome deformities of the kind than efforts directed forcibly to straighten the limb, either at one operation or by means of instruments contrived to keep up gradual extension of the leg on the thigh; for, as I have said before, it is frequently impossible in these cases to retain the tibia in apposition with the femur, in consequence of the intense pain it causes the patient, and from the abnormal growth which occurs in the anterior part of the condyle of the femur (p. 191).

Excision of the Knee-Joint.—Of sixty-one cases of excision of the knee for gun-shot injuries of the joint, no less than forty-one of the patients died. Results such as these would seem to point to the necessity for amputating at the lower third of the thigh, instead of performing excision of the joint, in cases of gun-shot wounds, and the same remark applies to bad compound comminuted fractures of this joint, however the injuries may have been caused. It may be, however, that under the Listerian system of treatment results much better than those I have referred to can be attained, after excision of the knee-joint, in instances of comminuted fractures of the end of the femur and upper portion of the tibia.

In cases of injuries of this kind, the soft parts should be carefully syringed out with a 10 per cent. solution of carbolic acid. Dependent openings must then be made into the joint, and drainage tubes passed into the articulation to prevent the accumulation of any discharges in or about the wound. It is impossible, however, to succeed in a case of this kind unless the limb is kept perfectly at rest by properly-applied splints, made so as to fit to the thigh and leg with arched brackets extending on either side of the knee-joint; by means of such a splint we can change the dressings without in the slightest degree moving the limb. We may fairly hope, by careful treatment of this kind, provided our patient is in good health at the time of the accident, to save his limb; but as I have said before, if, in spite of all our care, the patient's temperature rises, and symptoms of septicæmia, or, still worse, pyæmia, manifest themselves, amputation of the thigh gives a better hope of saving life than excision of the joint.

It is generally considered that in cases of disease "excision of the joint cannot be successfully performed after the middle period of life." There are, however, exceptions to this rule. It would hardly be possible to have a better example of success after resection of the knee than the instance of Mrs. S. N., aged fifty-five, in the Chadwick Ward. She had been confined to her bed for two years from disease of the right knee. On opening the joint, we found extensive caries of the bones entering into the formation of the articulation; the extremities of the tibia and the femur were therefore removed under the carbolic spray, and the patient made a rapid and excellent recovery. She is now able to walk about on the limb without any difficulty. This operation is, no doubt, more dangerous when performed on a patient who has passed the adult period of life than in childhood. Nevertheless, among children under twelve years of age, excision of the knee, as regards its ultimate results, is too often unsatisfactory, because the removal of the epiphysis from the lower end of the femur practically stops the growth of the limb in length, and so, by the time the patient has reached his full height, the leg operated on is warped and useless. The surgical proceeding which has brought about this result is not of a dangerous nature in these young persons, but I think the operation is not justifiable, especially when it is performed to overcome anchylosis and deformity of the limb, which, as I have before explained, may generally be relieved by more scientific and satisfactory means. Supposing, however, in the case of a child suffering from disease of the knee, the affection, in place of subsiding and terminating in anchylosis, continues, sinuses constantly forming in connection with diseased bone, what are we to do? Under these circumstances, my belief is, that if the patient's digestion is still fairly good, and there is no evidence of marked albuminoid disease, by means of efficient drainage, rest, and fresh air and light, together with the exercise of great patience, in the majority of instances our younger patients will recover. In order to save life, however, an amputation of the lower third of the thigh will, in the long run, generally yield a better result than excision of the knee.

If the patient is over twelve or thirteen years of age, I should excise the knee-joint rather than amputate through the lower third of the thigh, although there will still be shortening of the limb, nevertheless the deformity will not be so great as in a younger child, because a boy or girl of thirteen years of age has completed to a considerable extent the height to which he or she is likely to grow. The results of excision of the knee have been so frequently successful among persons from thirteen years of age to the adult period of life, that there can be no question as to its being the proper operative proceeding to adopt among patients of this age suffering from otherwise incurable disease of the joint. The existence of lardaceous disease is not so great a bar to excision of the knee as it is to resection of the head of the femur, because in the former we can remove the whole of the affected bone, whereas in hip-disease we frequently have to leave behind a considerable portion of carious bone in the acetabulum, and so long as this remains the discharge continues, and the lardaceous disease will increase. I know of hardly any condition, however, which would induce me to break the rule of cutting into a joint before performing resection, for it is most necessary to ascertain the condition of the bones previous to excising any portion of them. Esmarch's bandage, by controlling hæmorrhage, is of great assistance to us in these operations, enabling us to examine the condition of the diseased bones in a more satisfactory manner than we could possibly do when they are bathed in blood.

It is hardly necessary for me to remark that excision of the knee-joint is seldom applicable to cases of pulpy degeneration of the synovial membrane, for, supposing the bones should be extensively involved, their removal would not cure the granular disease of the soft structures, which is the direct cause of the mischief in these cases. Not a few instances of this kind may be cured by destroying the diseased tissues (p. 377), anchylosis subsequently occurring, and should we fail in our efforts to bring about this desirable result, amputation of the limb must be resorted to.

Believing, as I do, that excision of the knee will, year by year, become less frequent in our hospitals, because the joint is so easily dealt with by incisions and efficient drainage, not only of the soft tissues, but also of the bones, it is nevertheless right you should be acquainted with the conclusions arrived at on this subject by surgeons who appear to hold different views to mine on the subject, but whose judgment and experience is worthy of our highest respect. Mr. T. Holmes, in his late address to the British Medical Association, at Cambridge, gives the results of excision of the knee performed during the five years ending 1878, in six of our large hospitals, as shown on p. 464.

Mr. Holmes is of opinion that—

"1. Excision of the knee is one of the indispensable resources of surgery, and is useful in all three classes of cases, viz., in those where, otherwise, amputation would be indicated; in those where the expectant treatment might succeed, but is dubious; and in cases of vicious anchylosis.

"2. As a substitute for amputation, it is indicated in early life, and in non-tuberculous subjects; in cases of limited caries of the bones, of degeneration of the synovial membrane, and in some conditions of necrosis of the articular surfaces; possibly also in abscess in the ends of the bones.

"3. As a substitute for the expectant treatment, it seems to be justifiable, and is extensively used in cases where the patient's circumstances and the slow progress of the case render the surgeon hopeless or very doubtful of recovery with sound anchylosis.

"4. It is also frequently used, and is very successful, in cases of vicious or deformed anchylosis.

"5. Attempts have been made to limit the place of excision by opening the joint and drainage, and by some other partial methods. These attempts have been fairly successful, especially in cases where the affection is rather of the synovial membrane than of the bones, and they deserve more extensive trial than they seem as yet to have obtained.

"6. At the same time, the mortality from excision of the knee seems of late years to have been so greatly diminished as to encourage the hope that the limit of age which it has been found necessary hitherto to observe may be extended, and it may be judged prudent to apply the operation to the treatment of the more chronic affections of later life, such as chronic rheumatic arthritis, more extensively than has been done up to the present time."

As I have before remarked, this latter class of cases, and those referred to by Mr. Holmes as instances of "vicious or deformed anchylosis," should not, in my opinion, be classified under the head of excisions of the knee-joint, for the simple reason that the joint has ceased to exist in these cases. The operation referred to is the removal of a piece of bone in order to overcome the deformity of a limb resulting from pre-existing disease of the knee-joint, which is a different thing from excising a large articulation of this kind.

Hospital.	No. of Cases.	Limits of Age.	Result.			General Observations.
			Died.	Failed.	Succeeded	
King's College	21	7 to 32	2 from pyæmia and tetanus	2	17	The two cases in which the operation is said to have failed were, a total failure in which amputation was recommended, but refused; and one in which the patient was unable to walk without crutches. During the same period, there were four cases in which either re-excision or some proceeding for straightening the limb or removing diseased bone was adopted, in all with apparent success.
St. Bartholomew's	24	2 under 5 years, 2 over 20 years	2 1 pyæmia, 1 not stated	7 all amp. 2 died	15	
Guy's	89	Not given	6	10	73	No deaths out of 37 cases in the last two years of the period.
St. George's ..	4	8 to 21	..	2 both amp; 1 died	2	The only death was after amputation.
St. Thomas's..	62	Early childhood to 40	8	12?	42	Of the 12 failures, 4 were amputated. I believe the 8 others are marked either as relieved or uncured.
Manchester ..	24	As above	..	8	16	All 8 unsuccessful cases amputated; one of these died; no other deaths.
Leeds	21	Do.	3	6	8	Four cases are unaccounted for. The 6 failures were all amputated, and, I believe, all recovered.
	245		21	47 4 unaccounted for	173	Of the 47 failures, I believe 36 were amputated.

Appendix to TABLE, *showing the line of practice pursued at each of the hospitals named.*

KING'S COLLEGE.—As a general rule, excisions of the knee are performed here in cases where the limb would otherwise have been amputated; but it is believed that some exceptions have been made to this rule, in cases where prolonged expectant treatment might have led to an ultimate cure with anchylosis. In the great majority of the cases marked as successful, the soundness of the bony union after excision has been verified.

ST. BARTHOLOMEW'S.—The operation is sometimes (but rarely) performed as a substitute for amputation—more commonly in order to cut short the disease, which may be likely to last an indefinite time, and then to leave an useless limb. It is very seldom resorted to in acute disease immediately threatening the patient's life. It is regarded as a favourable operation in cases of vicious anchylosis. It is scarcely ever performed after the age of thirty-five.

GUY'S.—The operation is only practised by some members of the staff, and is used chiefly as an operation of expediency in cases which might possibly, after years of waiting, be brought to a more or less successful issue. Sometimes it is undertaken as an exploratory operation, to be followed afterwards by amputation if necessary. It is regarded as almost free from danger, all the cases being treated on the strict antiseptic system.

ST. GEORGE'S.—The operation has been, from accidental causes, very rarely practised during the time under review. It is used as a substitute for amputation in chronic affections of the bones, rather than as an operation of expediency.

MANCHESTER.—At this hospital, the operation appears to be used chiefly as a substitute for the expectant treatment. Those are regarded as the most favourable cases in which no suppuration exists, as in chronic rheumatic arthritis and in vicious anchylosis; next, degeneration of the synovial membrane; next, disease of the cartilages; then affections of the bone; and, least of all, those of disease of the bones, complicated with sinuses. Incision, with drainage of joints, has much limited the field of excision at this hospital, many cases being by such measures brought to useful anchylosis.

LEEDS.—Much the same observations apply to this hospital. Here, also, the incision, with drainage of joints, has been found very successful. Still, excision is freely resorted to in patients free from constitutional disease, young, and not so deeply affected as to necessitate the removal of the growing epiphysial cartilages.

LIVERPOOL.—The operation seems rarely practised here, and is looked upon with little favour. Rest and extension, with incision and drainage if necessary, are believed able to cure such cases as are curable by excision.

DUBLIN.—The operation is not often practised in the hospitals of Dublin, and has never, as far as is known, been done in private. When used, it seems chiefly to be as a substitute for prolonged expectancy.

I am not prepared to affirm that I know of any affection of the knee, or of any other joint of the body, caused by primary disease of the articular cartilages; it is by no means improbable that such affections do occur, but the cartilages may be extensively altered in character without any symptoms of these changes being present during life. The cartilages frequently become involved in consequence of affections of the bones and synovial tissue, but from a clinical point of view, we need only concern ourselves with these alterations in the cartilages as a part of the general changes occurring in the diseased joints.

LOOSE BODIES OR CARTILAGES IN JOINTS.

Loose bodies, or cartilages as they are often called, cause so little inconvenience, except when they occur in the knee-joint, that we may refer to them specially in connection with this articulation, although they are frequently met with in the elbow and other articulations.

These bodies are sometimes formed of true cartilage, being outgrowths of the articular cartilages of the joints in which they exist, or it may be, they are simply detached processes of the synovial membrane, such as those which we frequently see hanging from the interior of this membrane into healthy joints. The symptoms which these loose bodies cause when they occur in the knee are very characteristic. The patient is probably unconscious of having anything the matter with his knee until he suddenly, when moving the joint as in walking, experiences a sharp pain in the articulation, and is at once compelled to rest the limb. After stretching or manipulating the joint, the pain probably passes away, and the patient can resume his walk as usual. Attacks of this kind succeed one another more or less frequently, but sometimes they cause a severe synovitis. A person is usually aware, from his sensations, that there is a loose body of some kind in the affected joint, and it not unfrequently happens by moving the limb into a particular position he can feel this something slip from between the ends of the bones, and he can then bring it immediately beneath the skin on one or other side of his patella, where it may be felt. The attacks of pain from which the patient suffers are produced by the loose cartilage slipping between the ends of the tibia and femur, and when the patient bears the weight of his body upon it, it causes the sudden acute and sickening pain which is so characteristic a symptom of this form of disease.

The treatment of this affection must depend somewhat on the circumstances of the patient, and we should always bear in mind the fact that, as a rule, it is not one, but several loose cartilages in the joint we have to deal with. For instance, in a case which lately came under my care, a young man was most anxious to enter the army, but was unable to do so in consequence of a loose cartilage in his right knee. The nature of the operation, involving the danger attending an opening into this large joint, having been explained to the patient, he was desirous of bearing the risk, in order, if possible, to be cured. I therefore first fixed the loose cartilage beneath the skin, and then cut down upon and removed it from the joint; this proceeding is the correct one to adopt in the case of persons who depend on their own exertions for a livelihood. Among elderly people, or those rarely inconvenienced, although having one or more loose cartilages in the knee, it is always advisable to use palliative measures in the form of a well-fitting elastic knee-cap or an india-rubber bandage bound round the joint, which should be worn during exercise. By means of some such simple contrivance as this, or by avoiding certain positions of the knee, a person in easy circumstances suffering from a loose body in the knee-joint will, in by far the majority of cases, get on very comfortably. I need hardly observe that we know of no means by which we can get rid of a loose cartilage of this kind except by cutting down upon and removing it from the joint. The difficulty in these cases is to find the cartilage after making the incision through the skin, for unless the loose cartilage is carefully fixed beforehand, it is very apt to slip away into the joint at the time of the operation, and so prevent us from extracting it. In order to avoid any such accident, I have declined to operate in cases of the kind unless I could first fix the cartilage beneath the integument either by means of my fingers, or, still better, by transfixing it with a needle and suture. In the case above referred to, the loose cartilage was transfixed by a needle in this manner and fixed beneath the skin to the outer side of the patella; the skin was then divided, and the loose body squeezed out of the joint without difficulty: it consisted of a small piece of cartilage; areas of calcareous matter were disseminated throughout its substance.

Cases of dislocation of the semilunar cartilages have been recorded from time to time. Mr. C. Lucas lately published an instance of this description. The patient, while descending a ladder, ricked his knee; the joint became suddenly locked, causing loss of power in the limb. When first seen, the knee was half flexed; when moved, the leg and foot jerked inwards with a sudden shock, at the same time a projection occurred on the outer side of the patella, which could be seen and felt; on fully extending the leg, this projection went back into its place. In most of the cases that have been reported, the fulness beneath the skin caused by the cartilage has appeared to the inner side of the ligamentum patellæ. The symptoms present in this case were somewhat similar to those of loose bodies in the joint, but the cartilage when protruding never varied its position, and was uninfluenced except by movements of the joint. The knee was encased in a plaster of Paris bandage, which was kept on for four months, at the end of which time passive motion was commenced, and the patient was subsequently discharged from the hospital cured. It might be supposed that the outer semilunar cartilage would be more often displaced than the inner one, for it is less securely attached; as a matter of fact, however, the inner cartilage is the one usually dislocated; and the only deformity it is said to occasion is a slight fulness beneath the skin to one side of the ligamentum patellæ, usually on the inner side.

DISEASES OF THE ANKLE-JOINT.

The ankle is probably more frequently sprained than any other joint in the body. An accident of this kind is attended with severe pain, which fortunately prevents the patient from using his injured limb, and by a few days of enforced rest and the application over the joint of ice-bags, the effused blood becomes absorbed; in a week or so the strained ligaments and tissues usually resume their normal functions. On the other hand, if after an injury of this kind the parts are not carefully kept at rest synovitis is very likely to result, leading, perhaps, to the formation of constricting bands around the joint, or the injury may become the starting point of serious disease of the ankle.

The synovial membrane of the ankle-joint is capable of containing more fluid when the foot is at right angles to the leg, than in any other position. In inflammation of this joint the foot is usually kept semiflexed; the synovial membrane, in consequence of the excess of fluid which it contains, bulges forwards in front of the malleoli, and fluctuation may then be felt, unless the subcutaneous tissues are very tense and swollen. Passive motion in the joint is not so much restricted in synovitis of the ankle as it is in similar affections of the knee and the hip-joint. The slightest movement or pressure over the diseased joint is, however, extremely painful, and to relieve the joint, on attempting to walk, the patient brings the fore part of his foot to the ground, and so raises his heel. The local temperature in serous inflammation of the ankle will not be more than three or four degrees higher than that of the corresponding joint of the opposite limb. In cases of this description, rest, ice-bags, and subsequently pressure by means of india-rubber bandages applied over the inflamed articulation, and subsequently counter-irritation, will, in the greater number of cases, cure the synovitis, the motion of the joint being perfectly restored.

Muco-purulent synovitis of the ankle-joint may be the result of an injury; it occasionally follows an attack of acute rheumatism; or it may be due to septic influences. Under any circumstances the symptoms are more acute than those attending serous synovitis; the temperature of the part is not only higher, but the patient also suffers from general pyrexia, the distended joint is extremely painful, and the patient is unable to put his foot to the ground, much less to walk.

In cases of suspected muco-purulent synovitis of the ankle-joint, I am in the habit of puncturing the joint with a grooved needle or aspirator, and allowing the fluid it contains to drain off. The needle having then been withdrawn, the ankle should be immediately surrounded with cotton wool, over which an india-rubber bandage must be applied tightly, and the leg and foot secured to a splint. Bands of adhesion, the result of synovitis, frequently occur round the ankle, and must be completely broken down by forcible flexion and extension of the joint, in order to overcome the lameness which they produce.

I know of no articulation in the body in which we have more frequent opportunities of demonstrating the effects of tuberculous inflammation than in cases of disease of the ankle-joint. Thus, an apparently healthy child develops symptoms of disease of one of his ankle-joints; the synovial sac becomes distended with fluid; there is no great pain in the part unless the patient attempts to bear the weight of his body upon it; fistulæ form, leading into the joint, and caries of the lower end of the tibia occurs. In instances of this kind I have seen undoubted examples of miliary tubercle scattered throughout the remains of the synovial tissue. These cases differ from white swelling of the joint in that they usually occur among children, and although they seem to commence in an attack of synovitis, it is not improbable the origin of the joint-mischief may have been an insidious form of osteo-myelitis of the lower end of the tibia.

When lecturing on tuberculous inflammation of bone I related the history of a case in which this form of disease appeared in the lower part of the tibia, and I am convinced that Professor C. Heuter is right when he remarks that the medulla of the lower end of the tibia is peculiarly liable to tuberculous affections. We frequently meet with cases among young persons of long-continued pain in the inferior extremity of the tibia, severe at times, and then passing away with little, if any, enlargement of the bone, but with considerable tenderness on pressure. These affections of the tibia may continue for years, ultimately getting well as the patient reaches puberty. It is not uncommon, however, in instances of chronic osteo-myelitis of the end of the tibia, to find the patient complaining principally of pain over the outer side of the os calcis; the real seat of the disease may be diagnosed by tenderness on pressure applied over the lower part of the leg. If cases of this kind are neglected (as they too frequently are among the poorer classes) they lead to synovitis, and to destruction of the ankle-joint.

With reference to the treatment of these cases (see p. 115), I am convinced by the exercise of great patience, sea air, careful and efficient drainage, drilling through the end of the bone, and dividing the tendo-achillis, that the majority of our younger patients may be cured, with a perfectly useful foot. Among adults chronic disease of the ankle is much more serious, the chances of saving the limb less hopeful, and, in fact, most instances of the kind, whether of traumatic origin or otherwise, pass into granular disease of the synovial membrane, and fistulæ occur, connected in many instances with necrosis of the structures surrounding the joint. But even in cases of this description pressure, exercised by means of an elastic bandage round the joint, sea air, efficient counter-irritation, and rest are means which may unquestionably frequently save the patient's foot, and lead to anchylosis between the tibia and astragalus. There are, however, cases of disease of the ankle met with in adults and young persons which do not depend upon granular disease of the synovial membrane; but which, nevertheless, resist all our efforts to cure them, and we must either excise the joint, perform a Syme's amputation, or else remove the limb at its lower third.

EXCISION OF THE ANKLE-JOINT.

I have already referred to a case of excision of the ankle-joint attended with very satisfactory results. This operation has now been performed so frequently that there can no longer be any doubt as to its practicability, and when successful it leaves the patient in a better condition than after an amputation, either at the lower third of the leg or at the ankle-joint. The late Mr. Hancock remarked that excision of the ankle-joint must be "restricted to selected cases of healthy inflammation of the ligaments, and not those which originate in the cancellous structure of the bones, and which Sir B. Brodie rightly attributes to struma." I can hardly assent to this opinion, for the majority of such cases, however bad they may seem, can be cured without resection of the joint, and I am certain that where this result is not attainable, that although the disease originated in tuberculous inflammation, we may, nevertheless, excise the ankle-joint with a good hope of success, and (unless under peculiar circumstances counter-indicative of the operation) I should advise resection of the joint, and this failing, the choice lies between either a Syme's operation or amputation of the leg. We do not often meet with lardaceous disease with rapid degeneration of health in affections of the ankle, such as we see in cases of morbus-coxarius or in cases of disease of the knee, and for this reason we are justified in deferring amputation until the patient has had the chance of recovery by excision, the operation being performed in the manner described by Mr. Hancock.

With reference to excision of the ankle-joint after gunshot injuries of the joint, the results up to the present time have been unsatisfactory; for instance, during the last American war, excision of the ankle was performed eight times, and no less than five of these patients died. So that in military practice after severe injuries of this kind immediate amputation of the foot above the ankle will, in the majority of cases, be the correct method of treatment. But in compound comminuted fracture of the bones entering into the formation of the ankle, unless the vessels and nerves around the joint have been hopelessly destroyed, we may, in civil practice, usually save the foot. The younger the patient the better his chance of recovery. Among adults, the occupation, state of health, and surroundings of the patient must greatly influence our prognosis, and the line of practice we should pursue in the various cases that come under our notice; but as a rule, in instances of severe compound comminuted fractures of the ankle-joint, if the progress of the case is unsatisfactory, after a month's treatment amputation yields a better result than excision of the joint.

LECTURE XVI.

DISEASES OF THE WRIST-JOINT. — THE ELBOW AND SHOULDER-JOINTS. — DISEASE OF THE SPINE AND SACRO-ILIAC JOINT.

THE wrist-joint is subject to precisely the same forms of disease as those I have described as occurring in the ankle and in the knee; it is therefore unnecessary for me to recapitulate the observations I have made regarding the course and treatment of these affections. But it is well to remember that in inflammation of the synovial membranes of the wrist the sheaths of the long tendons passing over the joint frequently become implicated, and if the inflammatory action is at all severe sinuses form along the course of these tendons, interfering with the action of the fingers, and not unfrequently leading to their becoming immovably flexed on the hand. To prevent this, it is necessary, if the disease of the wrist has lasted for any considerable time, to keep up passive motion of the fingers; it may also be necessary to retain the inflamed joint at rest for a time, but not too long, unless your object is to bring about anchylosis of the wrist; for if the inflamed joint be left for any lengthened period without motion, fixed tendons, such as I have above referred to, and fibrous bands almost certainly form outside the synovial membrane, and permanently limit the action of the articulation.

In the majority of cases of acute disease of the wrist, the patient, in order that he may obtain as much freedom from pain as possible, rests his hand on a cushion, and probably being in a recumbent position his arm is continually kept pronated. Under these circumstances the posterior ligament of the joint tends to dislocate the ulna backwards. This condition of things may be prevented by fixing the patient's wrist to a splint in a position intermediate between flexion and extension, as well as between pronation and supination, a position naturally assumed when the hand and arm are supported in a sling.

The wrist, even more than the ankle, is beneficially affected by the constant application of cold when the joint is acutely inflamed. Pressure also is very effective in diseases of the wrist, the elastic bandage evidently controlling the circulation of blood through the vessels, and so regulating the nutritive changes in the part. There are few cases of serous or muco-purulent synovitis in their earlier stages which do not improve under well-applied pressure with an elastic bandage round the wrist and hand. In chronic inflammation of the synovial membrane it may be advisable to draw off the fluid by puncturing the joint with a grooved needle or the aspirator, before applying pressure, friction, or counter-irritation—for instance :—

T. H., aged nineteen, was admitted into the H. Hoare Ward, on March 9th, suffering from disease of his right wrist, of two years' standing. He was a pale strumous-looking lad, who had been reared by the parish, and could give us no history of his parentage. Some two years ago T. H. fell and sprained his right wrist; in the course of a few days the joint became swollen and painful, and remained so up to the time of his admission into hospital. We found the outlines of the right wrist-joint were obliterated by a swelling which extended to the centre of the hand and about two inches above the radio-carpal articulation; the skin covering the part was of its natural colour. Pressure over this swelling, or any attempt to move the joint, caused the lad excessive pain; he was unable to supinate or extend the hand, but when it was flexed he could move his fingers. Fluctuation could be felt over the diseased joint. The patient being under the influence of ether, an incision was made through the skin, and a director was thrust into the swelling. A considerable quantity of dark, muco-purulent matter escaped through this opening. A counter-opening was then made, and a drainage tube passed through the joint; after which the part was surrounded with the antiseptic gauze, and an india-rubber bandage applied with some force over it.

Pressure, together with drainage of this kind, was kept up for a week, after which the tube was removed; the elastic bandage was continued for nearly three weeks. Under this treatment the swelling about the joint almost entirely disappeared. Counter-irritation was then employed, and the patient was sent to a convalescent home. The lad returned to the hospital at the end of the month, having lost all pain and gained considerable movement in the wrist-joint. He has since almost entirely recovered the use of his hand. The drainage tube was employed in this case because the disease was of long-standing; but as a rule, joints, especially the wrist, ankle, and knee, when acutely inflamed, are at once freed from pain, if the fluid they contain is drawn off; the patient will then bear the pressure of an elastic bandage, whereas, before evacuating the fluid, he could not tolerate the slightest pressure upon the joint.

But as in the ankle, so also in the wrist-joint, in cases of chronic synovitis arising irrespective of injury to the part, we must invariably take into consideration the probability of the disease depending on tuberculous osteo-myelitis. These cases occur most frequently among delicate anæmic patients in whose family history an inherited scrofulous tendency exists. The swelling of the joint in cases of this kind, frequently assumes the soft doughy character of granular disease of the articulation, rather than the more painful distended state of the joint, which is characteristic of serous or muco-purulent synovitis. In most of these instances of chronic disease, pressure exercised over the ends of the ulna indicates the existence of one or more tender spots in the bone. In fact, these cases consist essentially of tuberculous osteo-myelitis of one or more of the bones entering into the formation of the wrist, followed by the destruction of the articular cartilages, and too frequently by the subsequent complete disorganization of the joint (p. 92).

I have met with patients suffering in this way, especially young persons, who have been treated by preventing the accumulation of the products of disease or suppuration in or about the joints, together with the removal of dead bone, and subsequently by pressure, friction, and counter-irritation, who have made very good recoveries, not only preserving some amount of motion in the articulation, but, in the course of years, they have almost regained the use of their fingers, for in these cases progressive improvement continues for a very long time after the more serious symptoms of disease have passed away.

In forming our prognosis in instances of disease of the wrist, we must not overlook the fact, that restricted motion in this joint is far more appreciable by the patient than a corresponding want of movement in the ankle. A person can get about very well with partial anchylosis of the ankle, and in time the increased movements between the bones of the foot almost compensate for that which has been lost in the ankle-joint; but restricted motion of the wrist-joint is a great hindrance in consequence of the delicate work the hand has to perform. This consideration must, if anything, add force to the rule I have so frequently inculcated, that to treat affections of joints successfully they must be treated early, or at any rate before serious damage has been done to the delicate structures upon which their movements depend.

Excision of the Wrist-Joint.—Before attempting to excise the wrist-joint, it is evidently well to consider the objects we have in view. This operation is not simply intended to remove dead bone, but also to preserve the hand as an instrument of prehension. In long-continued disease of the wrist, however, and especially in those cases in which the bones are implicated and sinuses have formed, the tendons passing over the articulation are generally involved, and the fingers become flexed and immovable. Under these circumstances, excision of the joint will not restore motion to the fingers, but in proportion to the length of bone removed there must be a corresponding contraction of the tendons passing from the forearm to the hand before the muscles can act efficiently on the fingers. No doubt we meet with cases of granular disease of the synovial membrane of the wrist in which abscesses form external to the joint, and if neglected caries of the bones may occur, but, as a rule, in instances of this description, the diseased action being one of degeneration rather than of inflammation, the tendons passing over the joint remain comparatively healthy. In such a case, however, it is seldom that the disease cannot be overcome by treatment short of resection of the joint, supposing the bones are diseased. For these reasons it would seem that it is only in exceptional cases that resection of the wrist is necessary, or likely to be attended with favourable results; and if we can secure anchylosis without excision, the patient will, as a rule, have a much better hand than he is likely to gain after the resection of the bones entering into the formation of this articulation.

We are not unfrequently, however, called upon to perform a modified resection of the wrist, that is, to remove dead bone from the end of the ulnar or articular surface of the carpal bones by means of the forceps and gouge; but as Mr. T. Holmes observes, "the formal excision of the whole of the wrist for extensive disease, which is almost always strumous, is an operation which is regarded with little confidence even by those who are most zealous advocates for excision of joints." It is argued that resection, to be successful, should be performed at an early stage of disease, and that it is because surgeons delay the operation too long that it so frequently fails. This argument would be correct, if we did not see cases of serious wrist-joint disease which make very good recoveries without any such formidable operation as excision. My own practice is, to try patiently every means of treatment at my command to relieve the disease, and if my efforts fail, then to cut into the joint and examine the articular ends of the bones. They will seldom be necrosed, but carious bone may be removed by the gouge, and then with the aid of free drainage anchylosis of the joint ought to be secured. If the condition of the patient and the limb is such as to preclude all hope of recovery by treatment such as I have described, I should advise amputation rather than resection of the joint. This rule applies not only to instances of disease, but also to gunshot wounds, and other compound comminuted fractures, unless the damage done to the joint is slight, and there seems to be a good hope of saving the limb with anchylosis. Where an operation is necessary excision of the joint may be undertaken if it can be performed within a few hours of the accident, although I consider that in the majority of such cases it is well to warn the patient that amputation may subsequently be necessary; and, in truth, in several cases of resection of the wrist-joint after wounds, which I have seen, the patient would have been better off with an artificial hand than with the mutilated remains of the one left after the operation.

DISEASES OF THE ELBOW-JOINT.

The elbow resembles the hip-joint in the number of the epiphyses which, until the adult period of life, are enclosed within its synovial membrane. The epiphyses of the lower articular extremity of the humerus are situated within the synovial sac: this membrane is also intimately connected with the epiphyses of the condyles, and it encloses those of the head of the radius and upper extremity of the ulna. I have referred to the fact that in cases of inherited syphilis, tuberculous inflammation, and as a consequence of contusion, that the soft and rapidly-growing structures situated between the diaphyses and epiphyses are frequently the point of origin of serious disease; and if, as in the case of the elbow and hip-joints, these tender parts are situated within the synovial membrane, abnormal action commencing in them is apt to implicate the synovial sac. Synovitis thus established reacts upon the structures entering into the formation of the joint; and so, from lesions which at first seem to be of small importance, serious consequences may ensue. In the out-patient department of our hospitals, we not unfrequently have children brought to us who have fallen, or in some other way injured one of their arms; the elbow-joint is, perhaps, much swollen and extremely tender, the slightest movement of the limb causing intense pain. Under these circumstances, it is advisable to administer anæsthetics, and then carefully examine the joint, first as regards its movements; if these are free, except such want of motion as may be accounted for by the swelling of the soft parts, it is not likely that the case is one of dislocation, which, if it exists, the sooner it is reduced the better. To leave a luxation unreduced is not only bad surgery, but is sure to be followed by considerable impairment in the movements of the joint. Supposing, however, the case is not one of dislocation, and that no fracture can be detected, it is nevertheless possible that the injury may consist in a contusion with separation of one or more of the epiphyses, especially that of the outer articular extremity of the humerus. An injury of this kind immediately after the accident does not prevent the child from moving his elbow, but in every movement of the joint the damaged tissues are more or less irritated, and acute serous synovitis is produced with distension of the membrane with fluid, and considerable swelling of the soft parts external to it. In consequence of the pressure of the surrounding muscles, the fluid in the joint can only fully distend the synovial sac on either side of the tendon of the triceps, but even in this locality it is frequently difficult to detect fluctuation.

The question naturally arises as to the line of treatment to be followed in a case of this kind. Our prognosis must evidently be guarded, considering that we are uncertain as to the exact nature of the injury from which the patient suffers. It is useless, and may be harmful, to examine a joint at all roughly in the condition I have described. Having satisfied ourselves that there is no dislocation or fracture, it is advisable to secure the forearm at right angles with the arm by means of a splint, and then to apply ice-bags over the inflamed joint, and to retain the limb at perfect rest for a fortnight or three weeks. We may then commence with friction over the joint, and passive motion of the forearm on the arm. Movement of this kind is very necessary, because bands of adhesion resulting from synovitis are apt to grow about the elbow-joint, and subsequently render the arm almost useless in consequence of the pain and inability they cause in all attempts to move the limb. These cases are, perhaps, with the exception of a similar condition in the shoulder, the most unsatisfactory instances of stiff joints we have to treat. I have found, as a rule, that the best plan of treatment to pursue for the relief of painful and stiff elbow-joints, such as I have referred to, is to place the patient under the effects of ether, and then forcibly flex the limb. The arm should subsequently be kept at rest for a few days with an ice-bag applied over the joint, if it is at all inflamed; passive motion, and friction for about fifteen minutes daily, must be used for three weeks or a month. It is seldom we can cure these cases unless by treatment of this kind, but I feel sure that in the first instance it is necessary completely to break down all the bands of adhesion that have formed round the joint by forcible flexion and extension of the limb. Passive motion will not effect a satisfactory result in these cases unless the bands of adhesion are first broken through.

On the other hand, nothing is more likely to set up serious disease in this joint, after a recent injury, than to manipulate it too freely in order to satisfy ourselves as to the exact nature or extent of the lesion which it has sustained. Having assured ourselves as to there being no dislocation, further manipulation is, as a rule, only too likely to lead to acute disease of the joint, and muco-purulent inflammation may be the result; matter forms within the synovial sac, and the bones, cartilages, and ligaments of the articulation become implicated in the diseased action; sinuses too commonly form connected with carious bone, necessitating, very often, the resection of the joint.

Among adults, necrosis of a portion of the bones entering into the formation of the elbow is more frequently met with as a result of an injury than caries, and it is not uncommon, therefore, for the surgeon to be able to overcome long-standing disease of this joint by the removal of a piece of dead bone. In the case of children, caries of a considerable portion of the ends of the bones, under circumstances such as I have referred to, may oblige us to excise the joint. On the other hand, the younger the patient the better chance he has of recovering from disease of the elbow, resulting either from injury or from constitutional causes, without any surgical interference beyond, perhaps, that of dividing the tendon of the triceps muscle to relieve the pressure of the diseased bones against one another, and making free openings through the soft tissues, so as to prevent the accumulation of matter in or about the articulation. Treatment of this kind, the arm at the same time being kept perfectly at rest, and the patient under favourable hygienic conditions, will often lead to a satisfactory result.

Granular disease of the synovial membrane of the elbow is frequently met with among persons of all ages, and unless treated by well-applied pressure, together with counter-irritation in its earlier stages, it almost invariably leads to destruction of the articular cartilages and bones of the joint. It is of little use simply removing dead bone in cases of this kind, unless the diseased subcutaneous tissues surrounding the joint are destroyed by the application of chloride of zinc or some other escharotic. Considering, however, the comparative slight danger to life which attends excision of the elbow, we should almost invariably resort to this operation in the hope of curing disease in this joint before condemning the limb to amputation. The safe rule is, in doubtful cases, to cut into the joint, and examine the condition of the bones before determining what further proceedings we should adopt. It is quite possible that a piece of necrosed bone in the neighbourhood of the joint, by keeping up irritation, may excite the growth of granular bodies in the surrounding soft tissues, and the removal of the dead bone may be the starting-point of a new and healthy action in the part.

It is unnecessary for me to refer to the circumstances of serous or muco-purulent synovitis of the elbow, occurring irrespective of an injury, for these affections do not differ from similar diseases of other joints, and are generally due to rheumatism or to septic influences. This joint is very commonly the seat of osteo-arthritis, resulting in the growth of osteophytes around the articulation, which frequently increase to a very considerable size.

Loose bodies are common in the elbow, and, as in the knee, we not unfrequently meet with several of them in the same joint. They are apt to give rise to attacks of serous synovitis, but in consequence of the functions which the elbow has to perform, and the comparatively small size of the joint, these loose bodies are of less importance than those which form in the knee.

Excision of the Elbow-Joint.—I referred in a disparaging tone to resections of the hip, knee, and wrist-joints among adult patients, but in disease of the elbow there can be no question as to the favourable results which frequently follow excision of the joint. In performing this operation, we do not seek simply to remove the diseased bones, but also to procure fibrous union between the arm and the forearm, so as to get a useful joint. Excision of the elbow is also a perfectly justifiable proceeding in cases of bony anchylosis, when the forearm has become united to the arm in such a position as to be of little use to the patient; we may not only rectify the deformity by means of excision, but in many cases secure a movable joint. In instances of malposition of the elbow with fibrous anchylosis, the patient being under the influence of anæsthetics, the deformity may generally be overcome by forcibly extending and flexing the limb, and subsequently keeping up passive motion of the joint, so that excision is seldom necessary in cases of this kind; the operation is hardly justifiable in instances of bony anchylosis in which the forearm has become fixed at a right angle to the arm. It is advisable in all cases, especially among adult patients, before proceeding to excision, to open the joint and thoroughly examine the condition of the bones, because, as I have before remarked, a piece of necrosed bone may be at the root of all the mischief that is going on in the part, and if the dead bone is removed, healthy action may be established, and a considerable portion of the joint saved. With these exceptions, however, excision is the operation almost invariably to be resorted to in all cases of otherwise incurable disease of the elbow-joint.

With reference to gun-shot injuries of the elbow, and severe compound comminuted fractures of this joint, provided the vessels and nerves of the arm have not been so severely injured as to render excision useless, this operation should be undertaken, if possible, immediately after the injury. Abscission of the joint performed some days subsequent to an accident of this kind is by no means so successful, in consequence of acute osteo-myelitis having, in all probability, been established within the ends of the injured bones.

DISEASES OF THE SHOULDER-JOINT.

Atrophy and absorption of the head of the humerus, like that of the femur and the extremities of other bones, follows osteo-myelitis, nerve-lesions, or intracapsular fractures, in adults; in the case of children, in addition to the above-mentioned causes, atrophy of the head of the humerus may occur from the separation of the epiphyses of the head from the diaphyses.

There can be no question that atrophy of the head of the humerus has been met with in instances of locomotor ataxy, and after accidents involving the nerves supplying the muscles about the shoulder, such as a dislocation of the head of the humerus into the axilla. In cases of this kind, either from pressure upon, or rupture of, some of the fibres of the circumflex nerve, the nutrition of the head of the humerus may become interfered with, and in consequence, absorption takes place of the upper extremity of the bone. It is remarkable that in more than one recorded case of this kind, after the disappearance of the head of the bone, the medulla had sprouted out from the end of the shaft, bony union ultimately occurring between the scapula and the humerus, a useful limb resulting, with considerable movement of the arm depending upon the freedom with which the scapula moves on the thorax. It has been suggested that cases of this description are in reality instances of intra-capsular fracture which have been mistaken for dislocation of the head of the humerus into the axilla, the detached portion of the bone becoming absorbed, and subsequently osseous union taking place between the scapula and the anatomical neck of the humerus.

A still more obscure class of cases are from time to time met with, commencing in central nerve-lesions followed by absorption of the head of the humerus. These cases are probably due to locomotor ataxy, or rather to the lesions in the spinal cord which are the causes of this form of disease. The patient complains of neuralgic pains about the shoulder; there is absence of patella reflex action, together with the gait peculiar to sclerosis of the posterior columns of the spinal cord, and not unfrequently atrophy of the optic nerve; the deltoid muscle at the same time wastes away, and the extremity of the shaft of the humerus may be felt, the head of the bone having disappeared from the glenoid cavity. In an instance of this kind, which is still under my observation, the patient applied to me in 1876 for gradual loss of sight. He states that upwards of ten years ago he first suffered from what he then considered to be neuralgia of the right arm, followed by such an amount of loss of power in the limb that he was unable to move it without the aid of the other arm. He subsequently suffered from similar pains in both legs, which gradually became very feeble. At present this patient's memory is perfect; he can only count fingers with the left eye and is altogether blind with the right, the optic nerves in both eyes being atrophied. Patella reflex action is absent in both legs, and the patient, though still able to walk, has a very feeble and tottering gait. His right arm hangs by his side like a flail; the deltoid muscle is completely atrophied; the head of the humerus can no longer be felt in the glenoid cavity. It seems reasonable to suppose, therefore, that if sclerosis of a portion of the spinal cord, which unquestionably exists in this case, can lead to absorption of the head of the humerus, that it is quite possible extensive injury to the large nerves surrounding the shoulder might also be followed by atrophy of the head of the bone.

In the few authenticated cases of fractures of the anatomical neck of the humerus which have been recorded, union has occurred with the formation of a very large quantity of callus round the fragments of broken bone, intra-capsular fractures of the humerus thus differing from similar injuries to the head of the femur. But it seems most probable when union has occurred after fracture of the anatomical neck of the humerus, that the fracture has been an impacted one; otherwise it would seem almost impossible for the head of the bone to live and grow when separated from the shaft; we should rather expect absorption of the detached portion of the humerus to occur, and such, I think, must be the case, unless the fracture is impacted.

Before the adult period of life a blow or fall may cause separation of the upper epiphysis from the shaft of the humerus. An injury of this description is by no means easy to diagnose; nevertheless, if the soft structures round the joint are not much swollen, you may generally feel the head of the bone in its natural position, and on rotating the arm, the epiphysis remains motionless in the glenoid cavity; crepitation may not be detected specially in the case of children, the epiphysis being still cartilaginous. The following case occurred in Mr. Hancock's practice. His patient had been struck across the upper part of his right arm; the blow was severe, but the boy took no notice of it for two days. While wheeling a barrow he felt so much pain in the shoulder that he was compelled to give up work. A fortnight later a collection of matter had formed round the joint, extending backwards towards the scapula. An incision was made into the abscess, and the bone was then found to be fractured, the head of the humerus being separated from the shaft, the upper three inches of which were denuded of periosteum; this portion of the bone, together with the upper epiphysis, was removed, and the patient made a satisfactory recovery.

When lecturing on the subject of epiphysitis I mentioned a case somewhat similar to the above, and drew your attention to the fact that the inflammatory action, consequent on an injury of this kind, was likely to spread along the periosteum of the shaft of the bone, producing acute periostitis and extensive inflammation of the surrounding soft structures. The danger in such cases, over and above the injury to the joint and the death of the upper end of the shaft of the humerus, is osteo-myelitis, followed by septo-pyæmia, a danger which can only be averted by early and free incisions through the soft structures down to the bone, and efficient drainage so as to prevent injurious tension and the accumulation of pus in or about the inflamed structures.

I am disposed to think that cases described as acute atrophy of the head of the humerus, which are said to occur occasionally in healthy children, are instances of separation of the epiphyses from the diaphyses, the result, perhaps, of a jerk to the arm, or a fall. The symptoms produced at first are so slight that the exciting cause of the mischief is over-looked, but inflammation subsequently takes place in or about the joint, followed by acute periostitis of the humerus. It may be the real nature of the disease is never discovered, unless the surgeon cuts down upon the bone and examines the part with his fingers; and the cases I have related indicate how necessary it is to pursue this practice, which may be attended with the most satisfactory results (p. 79).

Osteo-arthritis of the shoulder is frequently met with; its symptoms and progress, however, differ in no essential particular from a similar affection of the other joints, the earlier symptoms being stiffness of the articulation with a crackling sensation on moving the arm; more or less pain, especially in wet weather. There is gradual wasting of the deltoid muscle. As the disease advances the joint becomes more rigid, the shoulder presents a wasted appearance, the head of the bone and the glenoid cavity are surrounded to a greater or less extent by osteophytes. The articular surface of the humerus often becomes eburnated from sclerosis of the sub-cartilaginous lamina of bone and the osseous tissue immediately beneath it. Synovitis, the result of rheumatism, seldom leads to destructive changes in the shoulder-joint. It is rare to meet with cases of tuberculous osteo-myelitis of the head of the humerus.

Blows or injuries over the deltoid muscle are sometimes followed by great pain, lasting for months, but unattended with either wasting of the muscle or other decided symptoms pointing to nerve-lesions. Cases of the kind may be due to sub-luxation of the head of the humerus, but not uncommonly to chronic inflammation of the bursæ situated beneath the deltoid, which leads to induration of the surrounding tissues and to synovitis of the joint. In these cases forcible movement of the limb in all directions is the most effective mode of treatment, so as to break down the bands of adhesion which have formed about the joint. Fibrous anchylosis of the shoulder is, however, as a rule, very difficult to overcome; we may easily break through the adhesions and relieve the pain and stiffness of the joint for a few days, but in spite of passive movement of the arm, continued perhaps for a considerable period, the adhesions frequently re-form, and the stiffness of the joint therefore recurs. In attempting to break down adhesions round the shoulder-joint the scapula must be fixed by means of a jack towel, firmly secured round the patient's body, during the time that full extension of the arm is being made, otherwise the scapula will move with the humerus, and thus prevent you from effecting your object.

Excision of the Shoulder-Joint.—In three of our large London hospitals, out of a total of 371 cases of excisions of joints, 107 were instances of disease of the hip, with 13 deaths; 139 of the knee, with 15 deaths; 10 of the ankle-joint, without a death; 7 of the shoulder, with 2 deaths; 101 of the elbow, with 10 deaths; 7 of the wrist-joint, without a death. So that in civil practice excision of the head of the humerus for disease has not been a successful operation, the mortality being three times higher than that of excision of the hip, knee, or elbow. After gunshot injuries, of 951 cases of excision of the shoulder, there was a mortality of 36·6 per cent.; the fatality of intermediary excision of the head of the humerus is ten per cent. higher than after primary operations; in fact, the death rate is so high after the former proceeding, that nothing but absolute necessity would justify an operation of the kind. The excision of the mutilated joint should be effected within twenty-four hours of the injury, or deferred for at least six weeks, but considering the lower rate of mortality attending an amputation of the shoulder, in cases where the head of the humerus has been so much injured as to demand either excision or amputation, we should, as a rule, advise the latter proceeding, unless the circumstances of the wounded man were such as to afford him the advantage of careful treatment, rest, and so on. Under these conditions we are justified in attempting to save the limb, and ultimately, if necessary, amputating at the shoulder.

DISEASES OF THE SPINE.

Diseases of the vertebral column, so far as they are included under the subject we are considering, may be divided into two classes, angular curvature, or Pott's disease, and lateral curvature. Spina bifida, tumours of various kinds, rigidity of the spine from the growth of osteophytes, mollities ossium, and such-like affections, scarcely come within the scope of lectures on diseases of joints.

When describing tuberculous affections of bone, I referred to an instance of Pott's disease of the spine, and detailed the pathological changes which are usually to be found in these cases (p. 100). The cancellated tissues of the bodies of the vertebræ, the os calcis, the extremities of the tibia and of the first metatarsal bone, among young people, are peculiarly liable to be affected with tuberculous ostitis, followed by caseous degeneration of the soft structures they contain. The medulla in these bones is frequently affected in circumscribed areas, and the trabecular network situated in these diseased spaces being isolated from healthy living tissue crumbles down, and forms the spiculæ of bone which are usually present in the pus derived from caries of the vertebræ; but while the process of destruction is proceeding in the diseased portion of the bones the surrounding healthy medulla is producing a quantity of new cells; many of these undergo fatty degeneration, and the matter thus formed ultimately forces its way along the lines of least resistance, and not unfrequently points either in the loins or below Poupart's ligament; if the cervical vertebræ, however, are diseased, abscesses, not uncommonly connected with it, point in the back of the pharynx, or it may be beneath the skin of the neck.

I may here remark that the two principal forms of spinal curvature depend on very different causes. Lateral curvature, in its earlier stages, is a deformity arising from a condition of general debility, increased, as a rule, by the patient having assumed a strained position for many successive hours during each day; the naturally erect position of the spinal column thus becomes contorted and curved, usually towards the right side. Angular curvature of the spine, on the other hand, depends upon the spinous processes of one or more of the vertebræ bulging backwards, in consequence of disintegration of the bodies of these bones. The bodies of the diseased vertebræ having crumbled away are no longer able to support the weight of the trunk, and so they are crushed or staved in, and their spinous processes are necessarily jammed outwards and backwards, producing the angular curvature which is characteristic of this affection. The curvature of the spine, under these circumstances, is an abrupt limited projection backwards of some of the spinous processes, and is quite unlike the curvature of the spine occasionally seen in children suffering from rickets, and sometimes among old people, caused by an increase of the natural curve of the spinal column.

Angular curvature of the spine, as I have already remarked, in the great majority of cases depends upon tuberculous inflammation of the medulla contained in the bodies of the vertebræ; the disease does not extend to the transverse processes or the arches of these bones. It is usually a chronic affection, so that as the destructive changes progress, the spinal cord has time to adapt itself to the gradually increasing curve of the spinal column, otherwise, from pressure on the cord and its nerves, paralysis of the lower extremities would be more frequently met with in cases of Pott's disease than is actually the case. There is one exception, however, to this gradual progress of the disease, for if caries of the two upper cervical vertebræ occur, by loosening the attachments of the transverse ligament, the odontoid process may suddenly come to press upon the upper portion of the spinal cord and produce instant death. It is well that you should be aware of this fact, and bear in mind the anatomical relations of these parts when called upon to treat cases of disease of the upper cervical vertebræ.

The next question we have to consider is how we may best diagnose cases of tuberculous disease of the bodies of the vertebræ in its early stages, and therefore, before angular curvature of the spine has occurred. The first point we should direct our attention to is the rigidity, or otherwise, of the large muscles of the back. Tuberculous inflammation of the bodies of one or more of the vertebræ can hardly exist without exciting spasmodic action in the neighbouring muscles. Thus, before a child complains of pain, if the cervical vertebræ are affected, a careful nurse, or mother, will have noticed that there is something peculiar in the way in which the child carries his head. After a time the child is pronounced to have a decided stiff neck, and his chin is not unfrequently drawn down and remains fixed in the various motions of his body. The care with which the patient seems to guard his neck from movement when playing with his companions is a notable feature of this form of disease. On examination, even in the earliest stages of these cases, the rigidity of the muscles of the back of the neck, as well as of the sterno-mastoids, may be detected. If, however, the little patient is laid on his back, you will find the rigidity of the muscles in the earlier stages of the disease almost disappears; when under the *complete* influence of ether, no vestige of the spasm is perceptible.

You will remember I insisted on the fact, that the primary and most reliable symptom of disease of the head of the femur is the stiffness with which the bone rotates in the acetabulum, in consequence of the spasm of the surrounding muscles; and so it is in cases of disease of the spine, the want of freedom in the movement of the muscles of the neck in the early stages of tubercular disease of the cervical vertebræ is generally an obvious symptom. The same remark applies to a similar affection of the lower dorsal and upper lumbar vertebræ, which is the most common seat of Pott's disease. Before we can elicit symptoms of pain, produced by pressure over the spinous processes of the vertebræ, if we carefully watch the patient we shall discover evidence of spasm of the muscles of his back. The child, under these circumstances, if asked to pick up any small object from the floor, does not bend forward and seize it as a healthy child would do, but he dips down upon the object, flexing his hips and knees and keeping his back erect so as to reach it by squatting on to it.

You should dismiss from your minds the idea that in commencing tubercular ostitis of the head of the femur or vertebræ pain is always the first symptom of the disease. If you hold to this notion, your most favourable opportunity for controlling the further progress of the malady may pass without your recognizing its nature.

Should the lower dorsal and lumbar vertebræ be primarily diseased, spasm is not unfrequently excited in the muscles of respiration, inducing the peculiar short grunting manner of breathing which is not uncommonly noticed, especially in children suffering from this form of disease. In the same way, if the cervical region is involved, the child may have some difficulty in swallowing, or a spasmodic laryngeal cough arising from this cause. Symptoms such as these, unless otherwise accounted for, should arouse suspicion in your minds as to the possibility of the symptoms depending upon affections of the cervical vertebræ.

In order that you may ascertain if there is pain in the spine connected with diseased vertebræ, and define the seat of it, supposing that the patient is a child, he should be laid naked across your lap with his face downwards, his arms hanging over one of your thighs, and his legs over the other, then gradually separate your thighs so as to extend the child's spine. While in this position, gently percuss along the spinous processes of the vertebræ, and if there is pain on pressure in one or more of them, you can hardly fail to discover it. While the child is in this position you may force the heads of the ribs against the vertebræ, and in this way, perhaps, discover tender points connected with the side of the bodies of the vertebræ. Lastly, the child being in the position I have described, bring your thighs together, and then place one of your hands on the patient's head and the other on the lower end of the sacrum, and force the vertebræ against one another. Whilst this manœuvre is being accomplished, supposing the disease is in the lower dorsal or lumbar region, you may sometimes notice a sudden spasm of the child's legs and arms; at the same moment he will cry out with pain.

If the patient is beyond the age of childhood, you cannot, of course, treat him in the manner I have described. Under these circumstances, percussion from above downwards along the spinous processes will usually elicit an expression of pain when the tender bone is struck. If the patient is directed to bear the weight of his body on his toes, and then bring his heels suddenly to the ground, supposing there is disease of the bodies of the vertebræ, a jerk of this kind will be almost certain to produce pain. If the disease is situated in the bodies of the cervical vertebræ, the stiff neck and local pain on pressing the head downwards indicate the nature and site of the affected bones.

With reference to the treatment of the early stages of tuberculous inflammation of the vertebræ, whether arising from an injury or otherwise, we must bear in mind the fact that the disease largely depends upon inherited defects or upon a faulty condition of the nutrition of the body. Under any circumstances, we must aim directly at supplying our patients with fresh air, light, and plenty of good wholesome food, combined with cod-liver oil and iron. Treatment of this description, which is so essential to the recovery from the disease under which the patient labours, is inconsistent with long confinement to bed or to a couch.

No doubt efficient mechanical support may be given to a diseased spine by means of a steel apparatus resting on the pelvis, with crutches proceeding from this base, and fixed under the axillæ. But appliances of this description are not only costly, but are, as a rule, neither so efficient nor so comfortable to the patient as a plaster of Paris bandage employed in the manner described by Dr. Sayre. By his well-known method of treatment the patient is suspended by his head and shoulders, and his spine being thus extended, the plaster of Paris bandage is carefully applied, care being taken that it incases the pelvis so as to make this bone the basis of support upon which the bandage, when hard, will rest.

A well-applied plaster of Paris bandage is of the greatest service in cases of commencing tuberculous disease in the bodies of the vertebræ, relieving the affected bones from pressure, and so counteracting the tendency which otherwise exists for the large muscles of the back to become spasmodically contracted. The patient is able, with a bandage of the kind, not only to assume the erect posture, but to walk about and enjoy the fresh air and exercise, without which, especially in young and growing children, it is impossible the nutritive functions of the body can be properly performed; and unless these matters are attended to, we are not giving our patients the means which both science and experience teach us most conduces to recovery.

Supposing, however, angular curvature of the spine to have been established before we are consulted as to the condition of the patient, what are we to do then?

If for some years the angular curvature of the spine has not increased, the pain, especially on pressure, and weakness from which the patient formerly complained having subsided, it is probable that anchylosis has already taken place between the bodies of the diseased vertebræ, and the best thing we can do in a case of this kind is to order some mechanical support, and of these I think the plaster of Paris bandage is the most convenient. I need hardly remark, however, that if we have reason to suppose that anchylosis has taken place between the diseased vertebræ, it is not advisable to run the risk of breaking down the new growth of bone by suspending the patient by his head and shoulders. Our object in employing the bandage is to support the diseased parts, and so facilitate the consolidation of the bone which is taking place.

Supposing, however, the case to be one of more recent angular curvature, and that on pressure being made over the projecting spinous processes the patient complains of pain in the part, it is probable that diseased action in the bodies of the vertebræ is still progressing. This diagnosis is confirmed, if, when the patient is laid flat on his back upon a hard and smooth surface, with his head slightly raised, he is not only free from pain, but the angular projection of the spine disappears. Under these conditions I know of no system of treatment which answers so well as the one proposed by Dr. Sayre, to which I have so frequently referred. In applying the plaster of Paris bandage it is well, in addition to the elastic cotton vest which the patient wears next his skin, to fix a pad of cotton wool over the projecting spinous processes, so as to protect the skin covering them from undue pressure by the plaster of Paris bandage, otherwise troublesome ulceration of the part may occur; the ulcer taking a considerable time to heal will much delay the treatment. The plaster of Paris bandage should be changed once a month, but I have frequently seen it worn by patients for a very much longer period without producing any ill effects.

With reference to the treatment of psoas and lumbar abscesses connected with caries of the vertebræ. In the first instance, their contents should be drawn off by an aspirator: it may be necessary to empty the abscess three or four times at varying intervals by this instrument. By keeping the sac of the abscess empty it gradually contracts; at the same time we should employ the plaster of Paris bandage, and take every possible means to improve the patient's general health; subsequently, as the abscess becomes smaller, and its contents more flocculent, it may be advisable to open the cavity by a valvular incision under the carbolic spray and antiseptic dressings, passing a drainage tube into the abscess.

These remarks apply equally to lumbar and to psoas abscesses. For instance:—T. F., aged seven, was admitted into the Luke ward on November 15th from the out-patient department, suffering from a swelling situated over the angle formed by the erector spinæ and the lower edge of the last rib on the left side. This lad's family history is good. He had no knowledge of a blow or injury to the back, but his parents stated that the boy had been falling off very much of late and could not join his companions in play; he had not complained of pain, but had constantly been restless at night, and frequently remained in bed for the greater part of the day. On admission the boy looked thin, pale, and out of health. On being undressed, an oval fluctuating tumour was found below the margin of the left lowest rib. It seems this swelling had been noticed about a month, and tincture of iodine had constantly been applied with the object of dispersing the swelling. There could be no question that this was a chronic abscess.

On pressing over the spines of the vertebræ the child did not complain of pain; nor did it inconvenience him when we pressed his head down upon the spine; but if he brought his heels suddenly to the ground, the jerk caused instant pain in the back. On directing the patient to pick up a coin from the floor, he did not bend over to it, but squatted down on his haunches so as to reach the object without moving his spine. Although he had no pain on pressure over the spinous processes of the vertebræ, he, nevertheless, complained at once of pain in the upper dorsal region if the ribs were forcibly pressed against the spine.

On November 15th I drew off about ten ounces of pus from the abscess in the back by means of the aspirator; immediately after evacuating the abscess a plaster of Paris bandage was applied, according to Sayre's method. This treatment gave the patient great relief, and the bandage was allowed to remain on for three weeks; it was then removed, and four ounces more pus drawn off from the abscess. The plaster of Paris bandage was again applied, being renewed about once a month. No matter formed in the back subsequently to the second operation, and now, upwards of a year after he came under our care, he has quite regained his health. He has a stiff back, but no angular curvature or indication of active disease in the spine; he must, however, continue the use of the bandages for another year or so. He has long since returned to school. There is considerable movement in his spinal column, so that in spite of caries of the vertebræ and subsequent suppuration, this patient appears to have recovered without anchylosis of the bodies of his vertebræ having taken place to any considerable extent. As a rule, however, it is evident that after destruction of one or more of the bodies of the vertebræ has occurred, and the affected bones have been staved in by the weight of the trunk above the diseased portion of the spine, the best we can hope for the patient is that anchylosis will take place between the sound vertebræ, above and below the diseased vertebræ, bridges of bone being thrown across the bodies of the vertebræ which have been destroyed by caries, so as to support the weakened spine.

If you examine specimens of anchylosed spines with angular curvature, you will observe how frequently the connecting bridges of osseous tissue and deposits of bone at the site of disease assume the dense porcelain-like appearance of the osteophytes produced round the extremities of bones affected with osteo-arthritis; this dense bone forms a firm cement, uniting the bodies of the healthy vertebræ together, and so guarding the spinal cord from injury.

LATERAL CURVATURE OF THE SPINE.

Opinions differ as to whether lateral curvature of the spine depends primarily upon alterations in the form of the intervertebral discs and the bodies of the vertebræ, due to inequality in the pressure applied to the two sides of the trunk upon abnormal action of the muscles of the back, the changes which occur in the vertebræ being the result of this irregular action. It is probable that in the greater number of cases of lateral curvature, not only the discs and vertebræ, but the muscles also contribute to produce the deformity. Of one thing we may be certain, which is, that lateral, unlike angular, curvature of the spine does not depend upon caries of the vertebræ, but usually upon careless habits, practised by rachitic children or delicate girls, in standing, walking, and sitting.

Lateral curvature of the spine is not so frequently met with among people living in the country as among the inhabitants of large cities, being, as a rule, due to debility, but it may arise from genu-valgum, and, in fact, from any deformity or disease by means of which one side of the pelvis is rendered higher or lower than the other side, as, for instance, in cases of morbus-coxarius. The obliquity of the pelvis in some cases of hip-joint disease produces a lumbar curve; and this is compensated by a dorsal curve in the spine in the opposite direction to that of the lumbar curvature. Delicate young girls and some boys between the ages of fourteen and twenty, deficient in muscular power as well as in nerve-energy, are apt to fall into careless habits, such as bearing the greater part of the weight of their bodies on one leg when standing. This necessarily tilts up one side of the pelvis and produces a corresponding lateral curvature of the lumbar vertebræ. After a time, through the influence of the muscular effort to maintain the erect position of the spine, a compensatory curve takes place in the vertebræ of the dorsal region. If the convexity of the curve in the lumbar spine is to the right, it will bend out to the left in the dorsal region.

Then, again, among weak children, the habit of sprawling over a desk for hours together when at their studies not unfrequently causes a distortion of the dorsal spine to the right side; and this, after no very long period, is followed by a compensatory curve in the lumbar vertebræ in the opposite direction. On the other hand, healthy, vigorous children, especially boys, as a rule, not only throw off their tricks of position in the play-ground, but by the constant use of all their muscles counteract the injurious influence produced by the continuous employment of any one set of muscles.

There must, in almost every case of lateral curvature of the spine, be a period during which the deformity is limited to one part of the vertebral column, that is, when the primary curve has not as yet led to the formation of the compensatory curve; it is important to notice this, because we may assert, with considerable confidence, that in any given case, if the primary curve only exists, the deformity may be overcome, but when the compensatory curve has once fully developed itself, rotation of the vertebræ upon one another, as I shall presently explain, will have taken place to a greater or less extent, and then the case becomes much more complicated.

If the primary curve has formed in the lumbar region from some affection or bad habit of standing, producing an oblique condition of the pelvis when the patient stands upright with his heels together, the ilium is depressed on the side of lumbar convexity, there is a hollow in the loins, and the opposite hip becomes prominent. It is hardly possible to mistake the appearance of the parts under these circumstances, and they are well defined from the early stages of lateral curvature of the lumbar region, existing before any compensatory curve has been developed in the dorsal vertebræ. If the curvature has commenced in the dorsal region, or is of a secondary character, when the patient stands with his heels together and his arms by his side, in the position of "attention," the level of his shoulders becomes altered, one being raised, the other depressed; the scapula, also, of the side to which the convexity of the curved vertebræ points becomes very prominent.

In cases of lateral curvature, such as I have referred to, if we make the patient bend forwards so as to touch the ground with his hands without flexing his knees, in the majority of cases no abnormal rigidity of the muscles of his back is observed, and the spinous processes of the vertebræ assume, relatively, if not absolutely, their normal position.

With reference, however, to the deviations of the spinous processes of the vertebræ from the perpendicular in cases of lateral curvature, we must take into consideration the fact that as a compensatory curve forms, the bodies of the vertebræ become rotated on one another, so that there may be no great deviation from the perpendicular line of the spinous processes, and yet a considerable amount of lateral curvature may exist. For instance, in this dried specimen of the vertebral column you may notice, that in the lumbar and dorsal regions, the anterior surface of the bodies of the vertebræ occupy the convexity of the curves, the vertebræ being rotated on one another in such a manner that while the anterior surface of their bodies look directly to the right in the lumbar, they face to the left in the dorsal region. Nevertheless, the perpendicular line of the spinous processes deviates only slightly from the perpendicular line below, and if during life in a case of this kind we were to confine our attention to the spines of the vertebræ, it would be hardly possible to conceive that a serious deformity existed. You will also observe that the bodies of the vertebræ in the centre of the lumbar and dorsal curve have grown wedge-shaped in consequence of the unequal pressure to which they were exposed, and doubtless the intervertebral discs in the fresh specimen were of the same form.

It is evident, therefore, that we must not confine our attention solely to the perpendicular line of the spinous processes when examining a case of lateral curvature. We have seen how frequently the transverse processes of the lumbar vertebræ become prominent towards the side of the spinal convexity in consequence of the rotation of the bodies of the vertebræ, and in the dorsal region the position of the ribs is, from the same cause, frequently very much altered. In this case, the rotation of the vertebræ being to the left, the angles of the ribs on the opposite side are rendered most prominent, and the intercostal spaces are wider than natural. On the opposite side the ribs have become flattened and almost overlap one another. These changes in the shape of the bony walls of the thorax must inevitably, in the course of time, greatly interfere with the functions of the viscera which the chest contains, and so lead to derangement of the patient's general health.

I must, however, caution you against imagining, because a deviation of the spine to the right of the perpendicular line occurs in the case of a delicate girl, that she is necessarily suffering from a serious affection, requiring long treatment and confinement to the recumbent position, etc. Many an anxious mother has discovered that her child has some slight deviation of the spine, and her fears, in place of being allayed, have not unfrequently been exaggerated by the surgeon she may have consulted on the subject, and so cunningly-devised chairs and mechanical supports are called into requisition. But slight deviation of the spine to the right, in the dorsal region, is not unfrequently met with among young growing people. In such a case care should be taken to overcome faulty position in standing or sitting; healthy exercise in the open air should be insisted on. Calisthenics, riding, swimming, rowing, and dancing are valuable means towards developing weak muscles, and with restored bodily vigour, in ninety-nine cases out of a hundred, the condition of the spine will improve, and the child grow up robust and strong, which she certainly will not do if made to lie for the greater part of the day on a couch, and when sitting up or taking exercise being encased in a steel apparatus, which, however well made, constantly reminds her of her weakness, and restrains every motion of her body.

As I have already explained, one of the most common symptoms of lateral curvature of the lumbar spine during its earlier stages is the oblique condition of the pelvis, and projection of the hip on the side of the concavity of the curve, together with some deviation of the spinous processes of the vertebræ from the perpendicular line. If the curvature commences in the dorsal region, one shoulder becomes higher than the other, and the scapula towards which the convexity of the curve is directed stands out prominently from the ribs. The projecting scapula may often be felt by the surgeon without removing the patient's dress, and he can insert the tips of his fingers between its posterior border and the ribs. But a prominent scapula, such as I have described, is not invariably caused by lateral curvature of the spine. The rhomboid and serratus magnus muscles of one side of the body may become more fully developed than on the other side, and by their action upon the scapulæ produce the appearance of the prominent shoulder-blade I have referred to, independently of any spinal deformity.

If, however, we are consulted regarding an undue prominence of one of the scapulæ, in the case of a delicate, growing girl, it is necessary to make a careful examination of her spine in the following manner: The patient must be undressed, and directed to stand in the position of "attention," which position must be strictly adhered to during our examination. With a pen, or coloured chalk, prepared for surface-marking, dots should be made over the spinous processes of the cervical and dorsal regions downwards to the sacrum; any deviation of the spinous processes from the perpendicular will thus be detected. In the early stages of lateral curvature—whatever deviation there may be—if the patient is a child, on lifting her from the ground by her shoulders the curvature of the spine disappears, to return directly the patient stands firmly on her feet again. If the patient is laid, face downwards, on a level surface, and slight extension made from her shoulders, or if she is made to bend forwards, keeping her knees straight, the curvature of the spine, as indicated by the line of the spinous processes of the vertebræ, disappears; and what is perhaps of more consequence, the symmetrical relations of the angles of the ribs in the dorsal region, and of the transverse processes in the lumbar region, resume their normal relations to one another. In more advanced cases, where rotation of the bodies of the vertebræ on one another has taken place, in extension of the spine by either of the methods above referred to, the curved line of the spinous processes may resume its natural position, but in consequence of the rotation of the bodies of the vertebræ upon one another, a deformity exists which is not altered, by extension of the spine, to any marked degree. In the dorsal region, if the bodies of the vertebræ have become rotated on one another, it is obvious that the angles of the ribs and the corresponding transverse processes must deviate from their normal relation to one another, a condition of things we must carefully study, for when once this contorted position of the bodies of the vertebræ upon one another has taken place, we can hardly expect completely to overcome the deformity, and unless the case is carefully watched, the curvature of the spine will increase.

In examining a patient, therefore, for lateral curvature of the spine, we must fix our attention not only on the deviation of the spinous processes of the vertebræ from the perpendicular, but also carefully observe the position of the transverse processes and the angles of the ribs, together with the conformation of the thorax and pelvis; otherwise we may fall into error, and because no great or perceptible deviation exists in the line of the spinous processes, pronounce a serious and advancing case of lateral curvature, with rotation of the bodies of the vertebræ, to be of no consequence, and so allow the opportunity for curing the disease to pass away.

There is frequently a considerable amount of pain, and often a highly sensitive state of the skin of the back, in the early stages of lateral curvature. When the deformity is confirmed, from distortion of the ribs, the lungs and abdominal viscera suffer abnormal compression, giving rise to permanent ill-health, pain in the back, and doubtless, in the majority of instances, the patient's life is one of suffering.

I need hardly caution you against mistaking a curvature of the spine, consequent on pleurisy or any other disease leading to immobility of one side of the thorax, and the falling in of the ribs, with that of lateral curvature such as I have described. I have, however, lately seen a case of this description, one side of the patient's chest being full of fluid, with a curvature of the spine to the opposite side, in which the diagnosis was made entirely with regard to this latter symptom, and the case pronounced to be one of lateral curvature without any reference to the large amount of fluid which existed in the pleura, and which necessarily gave rise to the deformity in the spinal column.

The treatment to be recommended in cases of lateral curvature of the spine in its earlier stages has already been referred to, and in reality consists in taking measures to invigorate the nutritive functions of the patient, and to bring the weakened muscles of the back into active play; and so long as a primary curvature of the spine exists only in one region of the back, the compensatory curve and consequent rotation of the vertebræ not having become developed, we may always, with exercise and careful treatment of this kind, fairly expect to cure the deformity. But when once the compensatory curve has become fully developed, we can seldom hope to cure the disease. We may prevent it from increasing, but can hardly expect to restore the bodies of the vertebræ to their natural position. We have had not a few cases of lateral curvature in the wards, in which the projecting hip on one side, together with the promiment scapula and altered position of the transverse processes and ribs, rendered it evident that a lumbar and dorsal curve existed. In these cases the patients have been slung according to Sayre's method, and a plaster of Paris bandage applied when the spine and its muscles were fully extended. When dry this jacket has been divided from above downwards in front, and made to lace up like a pair of stays, so that it can readily be removed, morning and evening, to allow the patients to go through a course of calisthenic exercises. Support of this kind has not only been very useful, but also of great comfort to the patients. Whatever mechanical means, however, are employed to support the weak muscles and ligaments, we must bear in mind the fact that the main object of our treatment is to strengthen these weak tissues, and this can only be done by careful attention to the patient's health, by an out-of-door life, and free movements of the limbs and muscles of the back, especially calculated to bring the weakened muscles into active and well-sustained exertion.

DISEASE OF THE ILIO-SACRAL SYNCHONDROSIS.

Disease of the sacro-iliac joint is occasionally caused by the ligaments of the pelvis being over stretched during pregnancy, the relaxed condition of the parts thus caused giving rise to considerable pain and difficulty in standing or walking. In most of these cases the ligaments gradually resume their normal conditions, but occasionally the pain lasts for a very considerable time, and is followed by inflammation of the joint. In the majority of instances, however, of ilio-sacral disease, a direct injury to the part is the exciting cause of the abnormal action; in other cases it is very difficult to determine what is the immediate cause of the disease: the following is a case in point.

Mrs. R., aged forty-two, was admitted into the hospital on August 1st. She was a delicate-looking person, and stated that three of her sisters had died of consumption. She had had seven children; the youngest was three years of age. She had never experienced any unusual difficulty during her confinements.

Towards the end of last May, after a long day's washing, she was seized with pain in the lower part of her back, and from that time up to the time of admission she had never been altogether free from pain. On asking the patient to point out to us on another person the situation in which she felt the pain, she put her hand directly over the left sacro-iliac joint. The pain which Mrs. R. felt was always much increased if she attempted to stand or bear any weight on her left leg; it was relieved when she was in the recumbent position.

The patient said that even in the early stage of the disease, if she were on her knees, she could not rise without the help of a table or something of the kind, by means of which she supported the weight of her body by her arms.

In July these symptoms increased to such an extent as to prevent her moving about, and she then, for the first time, detected a "swelling on the lower and left side of her back-bone."

On admission into the hospital we found that Mrs. R. was unable to stand; if she attempted to do so, her body was bent over to the right side. There was no pain on percussion along her spine, but very great pain over the left ilio-sacral joint, which was increased if pressure were made so as to force the ilium against the sacrum. There was no pain about the hip-joint or spasm of the muscles in this locality; in fact, no evidence of morbus-coxarius. An abscess was found about as large as a hen's egg in the gluteal region, external to the sacro-iliac joint on the left side. On opening this abscess, under the carbolic spray, I found a cavity, extending to the ilio-sacral synchondrosis. No dead bone could be detected. A drainage tube was passed into the cavity, and in six weeks' time the patient left the hospital at her own request. The pain, though relieved, was still severe, and it was with considerable difficulty that Mrs. R. could move from her bed. Soon after leaving the hospital, in September, the patient began to suffer from intense pain along the anterior part of her left thigh, as well as in her back; and on November 9th she was re-admitted into the hospital. We then found a sinus, extending from the site of the original abscess in the gluteal region to the left sacral joint. The pain in this joint was still very great. The left thigh was flexed on the body, and the pelvis tilted forward. When an attempt was made to extend the limb, there was no fulness over the hip-joint, and the femur could be easily rotated in the acetabulum. There was fulness and induration of the skin above Poupart's ligament on the left side. An abscess subsequently burst in this situation, after which the patient's thigh could be fully extended without pain. The quantity of matter that passed from the wound in the groin, and also in the gluteal region, was very considerable, and until this had stopped Mrs. R. was kept constantly on her back in bed. Early in January I found it practicable to surround the patient's left thigh and pelvis with a plaster of Paris bandage; the bandage was continued upwards as high as the thorax. This treatment gave the patient the greatest relief, and enabled her to be removed from her bed to the couch every day. The bandage was removed from time to time so as to cleanse her skin, but she continued to wear it until March, when she was able to walk about in comparative freedom from pain. She subsequently left the hospital, and after a month's residence at the seaside, returned to London with her health almost re-established, and with absolute freedom from pain in the previously affected joint. She has continued well and without any recurrence of the disease up to the present time, a period of nearly eighteen months.

Our prognosis regarding the issue of these cases must always be a guarded one, for few of them recover completely. Patients affected with sacro-iliac disease generally pass from bad to worse, and ultimately sink from exhaustion, caused by long-continued discharge from the joint. Dr. C. T. Poore, of New York, states that disease of the ilio-sacral joint occurs alike among children and old people; in fact, his statistics demonstrate that there is no one period of life in which people are more predisposed to this affection than another. And the same remark applies to sex; men are subject as well as women to disease of the ilio-sacral synchondrosis. Among the former, however, it is most frequently ascribed to a strain, as in lifting a heavy weight, whereas among women the most common exciting cause is injury received during a protracted labour. Gonorrhœal rheumatism and rheumatic gout have, in some cases, been the starting point of the disease.

The symptoms present in these cases are characterized by persistent pain in the sacro-iliac joint, generally on one side of the body, but there are exceptions to this rule. The pain is always increased when the patient stands, or if in any other way the pelvis is pressed against the sacrum. For instance, Mrs. R. was almost free from pain when lying on her back, except when pressure was exercised so as to force her left ilium against the sacrum; she then cried out from the pain she felt in the left synchondrosis. Mrs. R. stated that from the commencement of the disease this fixed pain in the region of the sacro-iliac articulation was very severe, that it was increased if she attempted to walk or stand on the left leg. She was comparatively free from pain when kneeling, but in rising was compelled to rest her arms on a table or chair, in order to support the weight of her body and relieve the pressure on the ilium. The only position in which she attained any real ease was in lying flat on her back. There were no symptoms, as I have before remarked, of angular curvature, tenderness, or want of mobility in her spinal column. When first Mrs. R. was admitted into the hospital, her left hip-joint could be moved without any inconvenience; subsequently she suffered from great pain along the anterior crural nerve, and her left thigh became flexed on the pelvis. The muscles surrounding her hip were rigid, and on moving the limb she experienced pain in the joint. At the same time a swelling appeared above Poupart's ligament, and this, combined with the previous history of the case and the perfect mobility of the head of the femur when rotated in the acetabulum, demonstrated to us with sufficient clearness that the disease did not originate in the hip-joint, but that the symptoms were referable to an abscess connected with the sacro-iliac synchondrosis. This opinion was subsequently confirmed by the abscess bursting in the groin. When the matter escaped the pain in the thigh, and the contraction of the muscles passing from the pelvis to the thigh, disappeared.

With reference to the formation of abscesses in the sacro-iliac disease, they appear, in the majority of cases, first in the gluteal region, generally near the crest of the ilium and external to the position of the synchondrosis.

It is important to make a free opening into an abscess of this kind, and then thoroughly to examine the condition of the bone with your fingers, for you may discover that the abscess leads to the sacro-iliac joint, and that there is absolute separation between the bones; the finger nail or a flexible probe may be passed between the sacrum and the ilium.

No doubt cases of necrosis of the ilium are almost incurable, and give rise to abscesses over the gluteal region, but not to the pain which is characteristic of sacro-iliac disease; moreover, there is seldom much difficulty in instances of this kind of determining the extent of the necrosis or caries of the bone which exists, and by careful inquiry into the nature of the symptoms we may eliminate instances of either disease of the spine or of the hip-joint, from cases of disease of the sacro-iliac synchondrosis.

With reference to the treatment of this disease, we should enforce rest in bed, and employ counter-irritation in the form of the actual cautery or iodine liniment to be painted over the gluteal region. If the pain continues, I think great benefit may be derived from a plaster of Paris bandage, well applied round the pelvis and abdomen so as to fix the surfaces of the sacro-iliac joint against one another for a time. The bandage may be continued down the thigh to the knee, on the affected side, so as to restrain the action of the muscles passing from the pelvis to the femurs. Abscesses, if they form, must be freely opened, drainage and antiseptic dressings being employed, and the patient kept in bed on his back. As soon as the discharge ceases, the plaster of Paris bandage may be applied as I have already described. Under careful treatment of this kind it is possible to remove the patient from his bed to a couch, and into the open air. I need hardly remark that strict attention must be paid to the state of the patient's general health, cod-liver oil and iron being administered, but above all, rest, pure air, and good food should be the means upon which we must rely, and which, in some cases, we may confidently trust will lead ultimately to our patient's recovery.

COCCYDYNIA.

Coccydynia is a comparatively rare form of disease; nevertheless, it is quite possible before you have been in practice for many years you may meet with cases of the kind.

The characteristic symptom of coccydynia is great pain in the region of the coccyx, increased by pressure, as, for instance, when the patient attempts to sit down, or if pressure is made with the fingers upon this bone. In consequence of the pain caused by pressure on the coccyx, a patient affected by coccydynia is seldom at ease unless in the recumbent position. In sitting down he endeavours to rest the gluteal region of one side on the edge of his seat, so as to prevent the coccyx from being pressed upon. There is pain in walking, and also when the bowels are relieved, and, in fact, in any movement or action of the levator ani or of the sphincter muscles of the rectum.

The most frequent cause of this disease is a heavy fall upon the buttock. In some cases the patient attributes the commencement of the disease to cold, such as that of sitting down in a damp spot. Among females the most frequent cause of coccydynia, however, is connected with a strain received during protracted or difficult labour. Under these varying circumstances it seems probable that the symptoms are caused by inflammatory action having been established in the sacro-coccygeal articulation, and subsequently to the growth of bands of adhesion between these bones, which, when the coccyx is moved, becomes stretched, and causes the patient frequently to suffer very great pain in the part. There must, however, be cases of coccydynia which do not depend upon this cause, the pain appearing to arise from some nerve-lesion, because instances of the disease are met with in which the entire coccyx has been removed, and still the patient has complained of intense pain in the lower part of the back, increased by pressure in the way I have described. We have lately had a case of coccydynia under treatment in the Chadwick Ward. Mrs. E., aged twenty-one, was admitted into the hospital on March 19th. She states that she has always had remarkably good health until the last ten months, since she was delivered of her first child. Since her confinement she has suffered from great pain in the lower part of her back, especially if she attempts to sit down, or on going to stool.

On admission into hospital, the patient appeared to be weak and out of health, and she attributed this to the constant pain she suffered, and from her having been compelled almost daily to take purgatives so as to keep her bowels relaxed, otherwise she suffered intense pain during the act of defecation. On examination we found the seat of pain was in the coccyx. The bone was not more movable than it should be, but if bent either backwards or forwards, it caused her intense pain.

Under these circumstances, Mrs. E. was put under the influence of ether, and with a tenotomy knife I separated, subcutaneously, the coccyx from the sacrum, also freeing the bone from the surrounding soft structures. The operation was performed in the hope of dividing any bands of adhesion which had formed between the sacrum and the coccyx; and this treatment was attended with marked relief, for within a few days the patient was able to sit up, and walk without the slightest inconvenience. I saw Mrs. E. some three months after the operation; she had no return of her former symptoms.

The plan adopted in this case was one suggested some years ago by Sir James Simpson for the relief of coccydynia, his idea being to separate the coccyx from the muscular and fibrous structures attached to it. To effect this object, he introduced a knife beneath the skin at a short distance from the tip of the coccyx; the blade of the instrument was passed along the posterior aspect, and then round the sides and in front of the bone, so as to divide its attachments, especially those connecting it with the sacrum.

If this operation failed to relieve the symptoms, Sir J. C. Simpson recommends that the whole of the bone should be removed.

Although I believe we are justified in attempting to alleviate the symptoms present in coccydynia by an operation of the kind, we are, nevertheless, bound to warn the patient beforehand that it is far from certain this proceeding will cure the disease, for in spite of all we can do, it not unfrequently happens that although temporary relief may be gained by an operation, the symptoms recur in the course of a few weeks, and may continue more or less constant for years, or, perhaps, for the remainder of the patient's life. Under these circumstances, hypodermic injections of morphia often allay the sufferings of the patient, or a suppository containing morphia may with advantage be passed into the rectum every night and morning. Attention to the patient's general health, however, and the removal, if possible, of any local irritation, may do as much to relieve the symptoms as sedatives.

APPENDICES.

APPENDIX A.

Case of Septicæmia arising from Epiphysitis and Acute Inflammation of the Tibia. Reported by Mr. J. Mortimer.

A. L., aged fourteen. The patient's mother stated that her husband died of consumption. She has seven children; one of them is in the hospital suffering from disease of the right hip-joint. A. L. received an injury to his right knee about four months before the commencement of his present illness, and since the accident he has complained, from time to time, of acute pain in the right leg. On the 26th of March his right knee became extremely painful and very much swollen. Under these circumstances he was brought to the hospital and on the 30th of March admitted into Dr. Allchin's wards as a case of acute rheumatism.

April 1st.—The patient's right knee and upper part of his leg was very much swollen and excessively painful. No other joint of his body was affected. His temperature rose to 105·4° in the evening. Pulse 149, and very feeble. Respiration 39. Urine, sp. gr. 1026, no albumen. No diarrhœa. Abdomen slightly distended, and tender on pressure. Heart's apex was normal in situation. No bruit. No pericardial affection. The patient complained of intense pain in the head, and intolerance of light. His conjunctivæ were injected.

Ordered—Milk and beef tea.
James' Powder, gr. iij., statim.
P. Ipecac. Co., gr. viij., at bedtime.
A blister to the right knee.

March 2nd.—Patient in much the same condition. His temperature rose to 106° in the evening.

March 3rd.—The patient complained greatly of pain in the head; he was in a state of muttering delirium, constantly picking at the bed-clothes; his heart's action was very feeble; tongue dry and brown. Temperature in the evening 105·6°. Takes nourishment freely.

Rep. James' Powder.

March 5th.—Much in the same condition, but rather more delirious. A swollen and red spot has appeared over the front of the patient's sternum. He was in an alarming state of exhaustion.

Brandy, ½ oz. every second hour.
Beef tea and Brand's essence of meat.

Mr. Macnamara was asked to see the patient to-day, and, after examining his leg, came to the conclusion that the boy was suffering from septicæmia, consequent on the absorption of matter from acutely inflamed bone at the upper epiphysis of the right tibia. The surface-temperature of the inflamed part was 102·5°; the corresponding spot of the other limb was 98°.

Ordered—The limb to be poulticed, and sulph. quin., gr. vj., to be administered every four hours.

March 6th.—The patient's condition was so critical that Mr. Macnamara recommended the subcutaneous injection of one-third of a grain of hydrochlorate of pilocarpine. At 10.10 a.m., pulse 120 just after injection. 10.12, patient's face slightly flushed, and the alæ nasi moving freely. Pupils dilated. 10.18, forehead slightly moist. Pulse 144. 10.23, beads of perspiration standing on the face. Pulse 138. 10.30, patient not perspiring freely. 10.32, patient vomiting freely and copiously. 10.35, patient still perspiring slightly. Pulse 150; passed urine, 18 oz. 10.40, patient still perspiring slightly. Pulse 154. 10.45, patient not perspiring so freely. Pulse 144. 10.50, same as above. Pulse 144. 10.55, same as above. Pulse 156. 11.0, patient's face just moist; vomited a yellow clear fluid. Pulse 160, but perspiring freely upon the chest. 11.15, still perspiring on the body, but not on face. Pulse 144. Patient vomiting a fluid, the same as before mentioned. 11.25, patient still perspiring on the neck and chest, but not upon the face. Pulse fuller, 154. 12 noon, patient still perspiring on the chest. Pulse 120, but does not expectorate any fluid. Temperature in the axilla 101·4°. 2.10 p.m. There was no appearance of matter having collected in any one particular part of the leg; the limb was doughy and swollen, but no fluctuation could be detected. A free incision was made over the inner part of the head of tibia. On cutting through the soft tissues no matter appeared; but on dividing the periosteum a considerable quantity of pus escaped from the wound, over which a poultice was applied. An enema was ordered of quinine, gr. xij., as the patient refused quinine in a draught.

March 7th.—Dr. Allchin ordered pot. bromid., gr. xx., chlor. hyd., gr. xx. The patient took this draught, and in a few minutes—less than ten—was under its influence. Respiration quick; heart's action extremely feeble; pupils contracted and insensible to light; the effects of the draught passed off in about half an hour. Patient continued delirious; it was very difficult to make him take food. Mr. Macnamara enlarged the wound previously made, but no more pus came from it. Ordered poultices to be applied; also to repeat the quinine enema. Patient has been taking Brand's extract and brandy, ½ oz. in milk, every hour.

March 8th.—No change in the condition of the patient; but he has not been able to answer questions rationally for the last forty-eight hours. 11.45. Two incisions were made in the patient's leg, one on the outer surface, the other above the incision made on Saturday; from the latter a quantity of pus escaped. The leg appeared doughy and œdematous, and very painful upon pressure. The discharge in the poultice was sanious. Ordered to repeat the chloral draught. Poultices to be continued and changed every four hours. Temperature from 102° to 104°.

March 9th.—The nurse stated that the patient slept last night after the draught, but was very restless and delirious all the remainder of the night. Patient refused to take his nourishment. Temperature 105°. Ordered poultices to be discontinued and the wounds to be dressed with carbolic oil on lint; patient to take champagne with brandy, in the proportion of ½ oz. of the latter and 2 oz. of former.

March 10th.—Patient appeared the same as yesterday. Tongue clear at edges, brown and furred in the centre, tremulous. Patient answered when spoken to. Pulse 150. Temperature from 102° to 103°. He was picking at the bed-clothes more than yesterday.

March 11th.—The patient slept for about two hours last night. Upon being spoken to, he answered sensibly, and then relapsed into low muttering delirium. Tongue had a wash-leather appearance; sordes upon lips. Pulse 140. Patient continued to take the champagne, etc. Ordered to have poultices applied to the leg in the day-time, and oiled lint at night.

March 12th.—The patient had a better night; he slept a good deal.

Ordered—℞. Acid. hydro. nitric. dil., ♏xv.
P. Cinchonæ, ♏xx.
Syrupi, ʒij.
Aquæ, ℥ij. t. d. s.

And the poultices and carbolic oiled lint to be continued as before. Pulse 132. Temperature from 101° to 104°.

March 13th.—Patient, so the nurse stated, had the best night since he has been in the Hospital. To continue the same treatment. Pulse 130. Temperature from 101° to 102°.

March 15th.—Patient had a good night; suffered from pain in the right shoulder, between the coracoid process and humerus. On the left ankle there was an abscess forming. Pulse 135.

March 16th.—The patient was restless at night; slept for about three hours. Continued to take his nourishment. The ankle not so much swollen as yesterday; the poultices and carbolic oil were continued. Also milk, beef tea, Brand's extract of meat, four eggs, champagne, and brandy.

March 17th.—Patient much the same as yesterday.

March 23rd.—Patient had a good night. To have port wine instead of champagne.

April 5th.—Urine acid, 1020; albumen, ¼. Pulse 110. Patient was placed under the influence of chloroform, and Mr. Macnamara examined the leg, and found the upper and anterior part of the tibia denuded.

April 6th.—Urine was not albuminous; the albumen might have been due to the eggs the patient was eating.

The patient was taken into the operating theatre, and having been placed under the influence of ether and an Esmarch's bandage applied, an incision was made along the whole length of the tibia. The shaft of the bone was found to be encased in a (periosteal) new growth of bone; at its lower portion, however, it seemed more healthy. The periosteum was carefully detached from the tibia, and then the shaft of the bone was sawn through above its lower epiphysis; the upper part of the diaphysis had been separated by the effects of disease from the epiphysis, so that when the shaft of the tibia had been denuded of its periosteum and divided below, it was easily lifted out of its position in the leg. The periosteum was left *in situ*, with a considerable quantity of newly-formed bone attached to it.

The wound was filled with dry lint and bandaged, after which it was secured to a splint, and the Esmarch's bandage was removed.

April 7th.—There was oozing of a good deal of blood and blood-stained fluid from the wound for some hours after the operation. An ice-bag was applied at 7 p.m., which checked the hæmorrhage to some extent, and the fluid which escaped afterwards was chiefly serous. Patient was very restless and screaming until 8 p.m.; ℥ss. of brandy was then given, and he went to sleep until 10 p.m. He had ℥ss. of brandy every three hours during the night, and Oj. milk.

April 8th.—Patient at 10 a.m. much quieter, and inclined to sleep. Pulse 128, much improved in character. Respiration 20, quiet and steady. Expression better. Tongue rather furred (brownish) at back of dorsum. Patient was quiet and rational. The pulse was better. During the day he took his food well and asked for meat: ℥ss. brandy every three hours. Is not particularly thirsty. Says his leg "shoots" now and then.

April 9th.—Patient had a good night. Pulse 130. At 11 a.m. the bandages and wadding were carefully removed, and the wounds syringed out, the limb remaining on the splint. The old dressings were saturated with blood and other discharge, and were slightly offensive. The bandaging was not carried over the incision, which had merely a piece of carbolized oiled lint laid over it. Patient's appetite and general condition remains satisfactory. Urine 1010, acid, pale yellow, and slightly clouded with urates; no albumen.

April 10th.—Patient had rather a restless night, but his general condition is not altered this morning. The wound was dressed, and the splint replaced by one having an opening cut in its upper part, corresponding to the incision which was made on the inner side of the calf. In the afternoon, there being considerable tension along the incision, all the sutures were removed. The parts were supported by strapping. Drainage tubes also removed.

April 13.—12.30 p.m. Motion at the knee-joint not being entirely checked by the splint, a longer one of similar description was substituted. There was some tendency to curving of the leg below the knee, with convexity outwards, and it was kept in position on splint by strapping placed at intervals, which also brought the edges of the incision together. Cradle-swing discontinued. Sandbags laid on each side of limb, with small pillows underneath it.

April 16th.—The wound looked very healthy, and has filled up with healthy tissue except a small place at its upper part, where cicatrization has taken place. There was a free discharge from posterior opening in the leg. A small spicula of bone came away in the pus from lower part of the limb.

From this time the patient's progress was very satisfactory.

December, 1880.—The patient has a large tibia, produced in place of the bone which was removed, and with the aid of a high-heeled boot can walk about perfectly well.

Immediately after the tibia had been removed from the patient's leg it was divided longitudinally, from above downwards. The upper surface of the diaphysis was black and necrosed, and, as I have before said, during life was separated from the epiphysis. We found that the whole of the medulla contained in the cancellated tissue of the upper half of the bone was in a state of acute inflammation, and the smell proceeding from the cut surface of the bone was most offensive. The absorption of this matter into the circulation was quite sufficient to account for the symptoms of septicæmia from which the patient had so long suffered. It is well, however, to bear in mind the fact that these symptoms of blood-poisoning were pronounced before any external air could possibly have gained access to the inflamed structures. This was clearly an instance of septicæmia not complicated with pyæmia. From first to last the patient was free from rigors. There was a considerable quantity of new bone formed external to the shaft, evidently produced from the periosteum.

A. B. was admitted into the hospital as a case of acute rheumatism (see also case, p. 71). The conviction grows on me that the subject of acute rheumatism requires careful investigation, for it seems that cases of septicæmia are, at times, lumped up with an affection depending upon atmospherical influences, and known as rheumatism. Very probably septicæmia and rheumatism are the result of chemical changes in some portion of the organic matter of the body; their symptoms are not very dissimilar; in fact, the clinical history of septicæmia requires to be differentiated from rheumatism in the same way as typhus has been separated from typhoid fever; when this has been done, it is quite possible that the diversity of opinion which at present exists as to the value of treatment in acute rheumatism may diminish. We seem to recognize the fact that not a few cases of acute rheumatism will get well, with rest, in a warm bed. There are other cases in which the heart becomes involved, and repeated attacks of rheumatism, sooner or later, destroy the patient; these cases are influenced for good by therapeutic remedies and a warm climate, if resorted to in the early stages of the disease. There is another class of cases not complicated with heart affections, which run a regular course, uninfluenced by any treatment. Most of these patients get well, but some die from hyper-pyrexia; these cases are probably not unfrequently due to septicæmia. It may be that the septic matter is absorbed into the blood from inflamed tonsils, in not a few instances from dead bone surrounding decayed teeth, or from chronic genito-urinary mischief, or some obscure local source of decomposing organic matter.

APPENDIX B.

Case of Septicemia arising from a Wound in the Perineum. Reported by Mr. J. W. Batterham.

A. B., aged twenty-four. Admitted into the Westminster Hospital on September 21st. The patient's previous history, as far as her health was concerned, was good, and her circumstances were such as to enable her to procure all the comforts of life. She came into the hospital to undergo an operation for the cure of a lacerated perineum, extending through the sphincter ani and lower inch of the rectum.

On the 6th of October the surfaces of the lacerated wound were incised, those of the rectum being brought together with cat-gut sutures, and those of the perineum by means of quilled sutures, and a gutta-percha plate for the perineum. It seems that in the bed next to A. B. there was a case of carcinoma of the uterus. From this patient a very fœtid smell proceeded.

October 12th.—The patient's temperature rose suddenly to 103°; her heart's action was extremely feeble. Pulse 140. Respiration remarkably shallow, although air freely entered the lungs. Tongue dry, furred. No cyanosis. Great pain in the head, and some intolerance of light.

October 13th.—Temperature from 102° to 104°. It is difficult to feel the pulsation of the heart, or to count the pulse. Features drawn; respiration 45, very shallow. No abnormal lung sounds. Urine free from albumen. The patient talks much in her sleep, but is quite collected and sensible during the day. Tongue dry. Bowels opened four times; motions loose and watery.

October 16th.—Continues much in the same condition. The symptoms are still very urgent, indicating great weakness of the heart. The diarrhœa continues. The temperature is never under 102°. There is no pain in the abdomen on pressure. The patient is quite calm and collected. She has broken out into profuse and stinking perspiration several times during the last twenty-four hours. There is a slight trace of albumen in the urine to-day. Diarrhœa ceased.

October 20th.—To-day the patient complained of intense pain in her left knee; the joint was found to be distended with fluid, and extremely tender; the skin over it of natural colour. Pulse 148. Respiration 48. Temperature 103°.

October 21st.—The left ankle is distended with fluid as well as the knee, and is equally painful.

October 25th.—The knee and ankle were less painful and swollen to-day, but the other symptoms remain much the same as before.

October 31st.—To-day the patient was seized with cough; there was no dulness over any part of the lungs, but rhonchi posteriorly. Respiration 50. Pulse 166. Temperature 104°.

November 5th.—The left knee, which had been somewhat less swollen and painful, was tense with fluid to-day. The patient evidently grows more emaciated and weaker; the perspirations are still very copious. No diarrhœa. Lungs clear. Temperature from 102° to 104°. Respiration about 45. Pulse seldom under 145. Tongue dry. Intellect clear. No pain except in the left knee and ankle-joint.

November 18th.—There is no material alteration in the condition of the patient, or of the symptoms from which she suffers, with the exception of a considerable swelling (abscess) which has appeared about the middle of the anterior surface of her left thigh. Knee and ankle still tense with fluid; no other joints of the body affected. Urine free from albumen. Perspiration profuse and very offensive. Heart's action most feeble. Temperature, respirations, and pulse continue much the same as in former reports.

November 25th.—Patient grows weaker; her mental faculties remain unimpaired; the temperature sometimes falls as low as 101°. There are sordes on the lips and teeth, but no diarrhœa.

December 16th.—The patient gradually sank, and died this morning. No post-mortem was allowed.

The treatment has been omitted from the records of this case, but in spite of the most anxious and persistent use of remedial measures, no advantage appeared to be derived from the drugs administered; hot fomentations relieved the joints. Stimulants and nourishing soups and food were freely employed from time to time, but the disease ran its course to a fatal termination, uninfluenced (so far as those who watched it could ascertain) by any of the various measures which were adopted to check its progress.

This patient was not under my care, but I had the opportunity of watching the case from its commencement to the fatal termination. The history and symptoms from which A. B. suffered led me, from the first, to express an opinion that the case was one of septicæmia, the poison probably being generated in the wound of the perineum and absorbed into the system. It is impossible for us to determine how far the organic matter diffused from the patient in the next bed to A. B. had, in the first instance, affected the matter formed on the surface of the wound; but it is evident that about five days after the operation she was seized with symptoms of septicæmia. The marked feebleness of the patient's heart pointed to almost complete paralysis of its muscular fibre. There were no rigors or symptoms of pyæmia. I believe that the septic poison, having been formed at the surface of the wound in the perineum, had been carried by the blood and deposited in the synovial cavities of the patient's left knee and ankle joints; septic changes had taken place in the contents of these articulations; and so they continued to supply the blood with poison, which in the end destroyed the patient.

INDEX.

Abscess of bone, 52 ; if deep-seated, examine bone, 76

Acute osteo-myelitis, 32 ; and septo-pyæmia, 33 ; from injury, 35 ; from cold, 39 ; amputation in, 35 ; site of, 38 ; pathology of, 42 ; treatment of, 48 ; pilocarpine in, 50, 533 ; quinine, 51

Amputation in cases of osteo-myelitis, 35 ; site of and disarticulation, 38 ; osteo-sarcoma, 326 ; malignant disease, 330 : tuberculcus disease, 121 ; in hip joint disease, 433

Antiseptic dressing in compound fracture, 253

Anchylosis prevented by subcartilaginous layer of bone, 22 ; division of tendons in, 90 ; from bands of adhesion, 363

Articular cartilage in osteo-arthritis, 391 ; in case of osteo-sarcoma, 213 ; in case of tuberculous disease, 94

Artery, nutrient, embolism of, 280 ; rupture of, 248

Acetabulum affected in tuberculous disease, 120 ; in disease of hip, 406 ; preventing excision, 445

Ataxic arthropathy, 397 ; atrophy of bone in, 403 ; condition of joint, 399, 401 ; pathology, 404 ; of humerus, 491

Ankle-joint, diseases of, 470 ; synovitis, 340, 471 ; muco-purulent, 344, 471 ; excision of, 474

Angular curvature of spine, 99, 497

Baths, use of, in osteo-arthritis, 395

Bone, atrophy of, 225, 403 ; brittle, said to exist among the insane, 222 ; caries of, 97,100,156 ; carcinoma of, 328 ; corpuscles in inflammation of medulla, 45 ; corpuscles, how produced, 5 ; corpuscles, result of the death of, 45 ; condition of, in acute periostitis, 64 ; and epiphysitis, 67, 70, 73 ; condition of, in acute sclerosis, 202 ; condition of, in acute osteo-myelitis, 42 ; condition in chronic osteo-myelitis, 55, 57 ; contusion of medulla, 238 ; contusion of medulla may be serious, 240 ; corpuscles, formation of, 5 ; cystic tumours of, 291 ; development of, from medulla, 2 ; development of outer layers, 10 ; does not form in cavity of syphilitic ulcers, 139 ; drilling through, in tuberculous disease, 115 ; chondroma of, 302 ; exostosis of, 281 ; formation of, in sarcoma, 314 ; fractures of, 245 ; fractures of, process of repair. 246 ; fractures, non-union of, 248 ; hypertrophy of, 188 ; inflammation of (see osteo-myelitis), 32 ; necrosis of, 139, 263 ; necrosis of, causes, 263 ; necrosis of, embolism of nutrient artery, 282 ; necrosis of, eruptive fevers, 278 ; necrosis of, formation of new bone after, 273 ; necrosis of ilium, 270 ; necrosis of, phosphorus fumes in, 274 ; necrosis of, removal of dead bone, 268, 277 ; necrosis of, in syphilitic disease, 139 ; necrosis of skull, 267 ; sarcomatous disease of, 306 ; sclerosis of, diffuse, 201 ; senile changes in, 227; senile changes in neck of femur, 230; syphilitic disease of, inherited, 128; syphilitic disease of, in infants, 141; syphilitic disease of, pathology, 135, 144; syphilitic disease of, treatment, 133, 134, 148, 152, 158; syphilitic disease of, necrosis in, 139; syphilitic disease of, gumma, 155; nodes, 153; syphilitic disease of, enlargement not ostitis, 135; syphilitic disease of, commences in periosteum, 133, 135, 150; tuberculous disease of, 87; tuberculous disease, treatment in early stages, 105; tuberculous disease, treatment in advanced stages, 113; tuberculous disease, drilling through, 115; tumours of, 283

Calcareous lamina of bone, 17; effect of, in disease, 22
Callus, provisional, 247
Cancellated tissue, vessels of, 17
Caries of bone, 97, 100, 156
Carcinoma, 328
Cartilage, articular, nutrition of, 17; articular, in tuberculous disease, 94; cells, proliferation of, 5, 10; cells in periosteum, 10; cells in sarcoma, 311; cells, myeloid, 313; cells, nutrition of, 17; fibroid degeneration of, 2, 94; loose in joints, 466, 488
Caseous degeneration of medulla, 97
Cautery, actual, in tuberculous disease, 113
Chronic osteo-myelitis, 52; sclerosis diffusa, 207; cartilage affected by, 94; causes of, 58; condition of bone in, 56, 57; medulla, condition of, 56; pathology of tuberculous, 58; symptoms of, 53, 70; synovitis in, treatment of, 61
Coccydynia, 527
Cold, result of, on medulla, 39
Condensing ostitis, 202
Contusion of medulla, 238
Cranium, disease of, in syphilis, 142
Cranio-tabes, 166
Curvature of spine, angular, 501; lateral, 510
Cytogenic tissue of medulla, 19
Cystic tumours of bone, 291; connected with teeth, 291; treatment, 294; hydatid, 296

Dactylitis syphilitica, 149
De Cosati on mollities-ossium, 217
Development of bone, 1
Diaphysis, 7
Diffuse sclerosis of bone, 201; microscopic appearances of, 206; hardness of, 202; removal of bone in, 205; pathology of, 206; symptoms of, 205
Division of tendons in contracted joints, 90
Drainage in tuberculous disease, 115;
Drilling through scrofulous bones, 115

Elbow-joint, diseases of, 483
Emboli, 257; in pyæmia (osteomyelitis), 31; in lungs, 31; in nutrient artery, cause of necrosis, 279
Enlargement of bone in syphilitic disease, 135; often very deceptive, 135
Epiphysitis, acute, 63; condition of bone in, 67, 69, 70; diagnosis of, head of femur, 79, 426; 66, 71, 72; extending to periosteum, 69, 75; in infants most common, 69; mistaken for joint disease, 71, 72; necessity for examination, 76; prognosis, 78; treatment, 78
Epulis, 323
Eruptive fevers, cause of necrosis, 278
Excision of ankle-joint, 474; excision of elbow-joint, 489; excision of hip-joint, 121, 444; excision of knee-joint, 458; excision of shoulder-joint, 496; excision of wrist-joint, 481

Excision of bone in children, 120; in hypertrophy of femur, 205; in necrosis, 273; in tuberculous disease, 120
Exostosis, ivory, 287; spongy, 283; springing from epiphysis, 283; symptoms of, 285, 288; treatment of, 286

Fatty embola, 257
Femur, exostosis of, 290; fracture of neck, 227; osteo-myelitis of, 433
Fibro-cellular tumour of bone, 302, 314
Foreign bodies in joint, 466
Formation of new bone after injury, 15, 246
Fracture of bone, 245; antiseptic dressing in, 252; compound, 252; emboli in, 257; non-union of, 248; process of repair in, 246; neck of femur, 227; neck of femur, non-union of, 232; neck of femur, pathology, 230; neck of femur, symptoms, 228; neck of femur, treatment, 235

Gibney, Dr., on tuberculous disease of bone, 103
Granular disease of synovial membrane, 371
Gumma of periosteum, 155

Hæmatoma of scalp, 299
Hip-joint, disease of, 406; diagnosis of, 407; head of femur fixed in acetabulum, 409; apparent lengthening of limb, 411; apparent shortening, 412; actual shortening, 428; muscular spasm, 412; pain, 413; lameness, 414; synovitis of, 417; cases of, 418; frequent cause of hip-disease, 421; treatment, 422, 424; epiphysitis of head of femur, 79, 426; cause of shortening of limb, 427; diagnosis of, 429; treatment, 431; osteo-myelitis of head of femur, 433; causes of, 434; prognosis of, 442; symptoms, 434; treatment, 436, 441; excision of head of femur, 444; amputation at hip-joint, 444
Holmes, Mr. T., on excision of knee-joint, 462; hip, 447; wrist, 482
Hydrops articuli, 381
Hydatid cysts in bone, 296
Hyperostosis, 195; caused by perverted nerve-action, 200; connection with sarcoma, 195; general, 196; pathology of, 197; primary stage of softening, 197; symptoms of, 198
Hypertrophy of bone, 188; excision of, 190; from want of pressure, 191; in rickets, 166

Ilium, necrosis of, 270
Inherited syphilitic disease of bone, 128
Infantile syphilitic disease of bone, 141
Inflammation of epiphysis, 63; medulla, acute osteo-myelitis, 32; medulla, chronic myelitis, 52; medulla, condition of bone in, 42; medulla, condition of cartilage, 43; medulla, condition of lacunæ, 44; medulla, necrosis in, 45; tuberculous, of bone, 94; tuberculous, of bone, calcareous changes in, 97; tuberculous, of bone, condition of bone, 94; tuberculous, of bone, condition of medulla, 95; tuberculous, of bone, no new bone formed in, 99, 101; tuberculous, of bone. symptoms, 91; tuberculous, of bone of vertebræ, 99; tuberculous, of bone, treatment in early stages, 105; tuberculous, of bone, treatment in advanced stages, 109; tuberculous, of bone, treatment by actual cautery, 113; tuberculous, of bone, treatment by drilling bone, 115; tuberculous, of bone, treatment by drainage, 116; tuberculous, of bone, treatment by

plaster of Paris bandage, 111; tuberculous, of bone, treatment by removal of dead bone, 120; tuberculous, of bone, treatment by strapping, 112
Insane patients supposed to have brittle bone, 222
Ivory exostosis, 287

Joints, diseases of, 338; general outline of, 340; ataxic arthropathy, 397; granular disease of synovial membrane, 371; hydrops articuli, 381; osteo-arthritis, 386; muco-purulent synovitis, 344; septic synovitis, 350; serous synovitis, 340; strumous synovitis, 371; suppurative synovitis, 356; stiff joints, the effects of synovitis, 363; tumor albus, 371
Joints, diseases of special joints, ankle, 470; knee, 449; elbow, 483; hip, 406; sacro-iliac, 520; shoulder, 490; wrist, 476; vertebræ, 497; coccydynia, 527

Knee-joint, disease of, 449; synovitis, 450; muco-purulent, 451; suppurative, 454; anchylosis of, 457; excision of, 458

Lacunæ, condition of, in acute osteo-myelitis, 44; condition of, in diffuse sclerosis, 209; formation of, in new bone, 6
Lamina, calcareous, anatomy of, 17; influence of, in disease, 22
Lardaceous disease, 440
Lateral curvature of spine, 510
Local hyperostosis, 199, 208
Loose bodies in joints, 466
Locomotor ataxy, 397, 491
Lymphadenoma, in bone, 123; allied to tuberculosis, 126

Malignant disease of bone, 328; infecting, 328; secondary, 335; symptoms, 330; treatment, 332
Medulla, anatomy of, 5; affected by carcinoma, 328; affected by sarcoma, 306: calcification of, 97; caseous changes in, 97; contusion of, 239; contusion of, may lead to permanent disease, 241; formation of new bone in, after injury, 247; formation of new bone from cartilage, 3; inflammation of, acute, 32; inflammation of, acute, symptoms, 33; inflammation of, acute, pathology, 42; inflammation of, acute, amputation in, 48; inflammation of, acute, pyæmia in, 33; inflammation of, acute, result of accident, 33; inflammation of, acute, result of cold, 39; inflammation of, acute, condition of bone, 42; inflammation of, chronic abscess, 52; inflammation of, chronic, symptoms, 60; inflammation of, chronic, opening into joints, 57; inflammation of, necrosis in, 43; inflammation of, tuberculous, 94; lymphadenoma of, 123; myeloid cells in, 6; in rickets, 177; in repair of fractured bones, 246; in syphilitic disease, 137; tuberculous disease of, 95; tuberculous disease of, pathology of, 95; tuberculous disease of, symptoms, 91; tuberculous disease of, no new bone, formed, 99; tuberculous disease of, scrofulous, 87, 103; tuberculous disease of, removal of, 120; tuberculous disease of, rest overdone, 106; tuberculous disease of, rest, amount of, 109; tuberculous disease of, treatment, early stages, 106; tuberculous disease of, treatment, more advanced stages, 112; tuberculous disease of, treatment, actual cautery, 113; tuberculous disease of, treatment, drilling, 115
Mercury in syphilitic affections of bone, 134, 148, 152
Mollities-ossium, 211; causes of,

215; due to carcinoma, 216; due to sarcoma, 214; due to pregnancy, 217; pathology of, 213; most common in females, 218; symptoms, 215
Muco-purulent synovitis, 344
Myeloid cells of medulla, 3; tumours of bone, 313, 315

Necrosis of bone, 139, 263; formation of new bone in, 273; from embolism of artery, 282; from eruptive fevers, 278; from inflammation, 42; from injury, 240, 264; from phosphorus fumes, 274; from syphilitic disease, 139; removal of dead bone, 268; neoplastic formation in, 139
Nerves, action of, in hypertrophy, 188; in locomotor ataxy, 492
Nodes, syphilitic, 153
Non-union of fractures, 248
Nutrition of cartilage, 18; of cancellated tissue, affected by external pressure, 18; affected by embolism of nutrient artery, 282; affected by rupture of nutrient artery, 248; affected by syphilitic affection of periosteum, 150

Osteo-arthritis, 386; bone, condition of, 391; cartilage, condition of, 392; medulla, condition of, 393; foreign bodies in joint, 390; general considerations regarding, 387; pathology, 391; sclerosis of ends of bone, 393; symptoms, 389; treatment, 394
Osteoid-chondroma, 302; pathology of, 303; symptoms, 304; treatment, 304
Osteo-malacia, 211
Osteo-myelitis, acute, 32; acute, amputation, site and time of, 48; acute, condition of bone in, 42; acute, lacunæ of bone in, 44; acute, pathology of, 43; acute, pyæmia in, 33; acute, result of injury, 33; acute, result of cold, 39; acute, symptoms, 32; chronic, symptoms, 60; chronic, condition of bone, 57; chronic, opening into knee, 57; of head of femur, 433; chronic, treatment, 55
Osteo-sarcoma, 306; condition of cartilage, 313; condition of bone, 315; condition of medulla, 314; does not infect tissues, 317; formation of bone in, 314; horse affected by, 327; jaws, favourite site of, 323; originates in cancellated tissue, 313; pathology of, 311; probability of return of pulsating (myeloid), 317, 330; recurrence of, 317, 330; treatment, 326, 332
Ostitis, acute (osteo-myelitis), 32; chronic, 52; condensing, 201

Paget, Sir J., on hyperostosis, 195
Parry, Dr., on rickets, 181
Pelvis, deformity of, in rickets, 171; in osteo-malacia, 217
Periosteum, contains nuclei of cartilage-cells, 10; formed from temporary cartilage, 11; lining chronic abscess of bone, 56
Periostitis, acute, 63; commencing in epiphysis, 65, 69; condition of bone in, 64
Periosteal affections in syphilis, 132, 149, 153; mercury in, 148, 152, 159
Phosphorus fumes in necrosis of jaws, 274
Plaster of Paris bandages in disease of bone, 111
Pulpy degeneration of joints, 371
Pulsating tumours of bone, 313, 315
Pyæmia, 24; diarrhœa in, 41: result of osteo-myelitis, 33; symptoms, 29; treatment, 48

Removal of ununited ends of bone, 23
Rest often overdone in tuberculous disease, 102, 108, 441

Rheumatic arthritis (chronic), 386 (see osteo-arthritis)
Ribs of insane patients, 224
Rickets, 160; a disease of cities, 173; alterations in shape of thorax, 172; causes of, 173; condition of bones in, 177; condition of medulla in, 178; condition of cartilage in, 178; disorders of nervous system in, 169; enlargement of extremities of ribs, 165; occipital bone, abnormalities of, 166; pathology of, 177; primary symptoms, 163; treatment, 181

Sacro-iliac joint-disease, 520
Sarcomatous disease of bone, 306; cause of general hyperostosis, 195
Sayre's splint in tuberculous disease, 111
Sclerosis of bone, 22, 208; diffuse, 201; hardness of, 203; microscopical appearances of, 206; pathology of, 206, 209; removal of, 205; symptoms of, 204, 207
Sclerosis of ends of fractured bones, 22; ends in osteo-arthritis, 393
Scrofula, in cases of bone-disease, 102, 105
Secretion of bone-earth by cartilage-cells, 3, 5
Sequestrum of bone, 286
Septicæmia, 24, 531, 540
Septic synovitis, 350, 540
Serous synovitis, 340
Shoulder-joint, disease of, 491
Skull, necrosis of, in syphilis, 140; after injury, 240, 267; re-formation of outer table of, 270
Softening of bones due to carcinoma, 216; due to sarcoma, 213
Spine, diseases of, 497
Subcartilaginous lamina of bone, 17; anchylosis effected by, 22; in osteo-arthritis, 393; in sarcoma, 311
Strumous synovitis, 371
Stiff joints, 363
Suppurative synovitis, 356
Syphilitic disease of bone, 128; commencing in periosteum, 132, 150; differs from tuberculosis, 136; enlargement of, not due to ostitis, 135; infantile, 141; gumma, 153; medulla, secondary affection, 139; necrosis in, 139; nodes, 153; patients unfavourable for operation, 134; pathology of, 135; symptoms of, 131; symptoms of, in infants, 143, 147, 151; thermometer in, 148; treatment of, 134, 148, 159
Synovitis, 338; general considerations regarding, 339; granular, 371; muco-purulent, 344; septic, 350; strumous, 371; serous, 340; suppurative, 356; stiff joints following, 363; osteo-arthritis resulting from, 386; ankle-joint, 470; elbow, 483; hip, 417; knee, 449; sacro-iliac, 520; shoulder, 490; spinal, 497; wrist, 476

Taylor, Dr. R. W., on syphilitic lesions of bone, 141, 151
Temperature in septicæmia, 27; in pyæmia, 29; syphilitic disease, 148; tuberculous disease, 119
Temporary cartilage, formation of bone from, 3; of periosteum, 10
Tuberculous inflammation of bone, 87; advantage of removing dead bone, 117; amount of motion in treatment of cases, 109; actual cautery in, 113; condition of bone, 95; of medulla, 96; differs from syphilitic, 136; induced by scrofula, 104; inherited tendencies in, 102, 105; not met with in India, 103; Sayre's treatment of, 111; strapping in, 112; temperature uncertain, 120; treatment, early stages, 106; treatment, more advanced stages, 113
Tumours of bone, 283; cystic, 291; chondroma, 302; exostosis, 283; exostosis, ivory, 287; mye-

loid, 312, 315; pulsating, 321; sarcomatous, 306; vascular, 298

Vascular tumours of bone, 298
Vertebræ, diseases of, 497; tuberculous, 99, 497; Sayre's bandage in, 111
Vessels of cancellated tissue of bone, 17; affected by pressure, 18
Vessels of medulla, 18

Wounds, antiseptic dressing in, 253; open dressing, 253
Wrist-joint, diseases of, 476

Pardon and Sons, Printers Paternoster Row, London.

[CATALOGUE C]

LONDON, *December*, 1881.

J. & A. CHURCHILL'S

MEDICAL CLASS BOOKS.

ANATOMY.

BRAUNE.—An Atlas of Topographical Anatomy, after Plane Sections of Frozen Bodies. By WILHELM BRAUNE, Professor of Anatomy in the University of Leipzig. Translated by EDWARD BELLAMY, F.R.C.S., and Member of the Board of Examiners; Surgeon to Charing Cross Hospital, and Lecturer on Anatomy in its School. With 34 Photo-lithographic Plates and 46 Woodcuts. Large imp. 8vo, 40s.

FLOWER.—Diagrams of the Nerves of the Human Body, exhibiting their Origin, Divisions, and Connexions, with their Distribution to the various Regions of the Cutaneous Surface, and to all the Muscles. By WILLIAM H. FLOWER, F.R.C.S., F.R.S., Hunterian Professor of Comparative Anatomy, and Conservator of the Museum, Royal College of Surgeons. Third Edition, containing 6 Plates. Royal 4to, 12s.

GODLEE.—An Atlas of Human Anatomy: illustrating most of the ordinary Dissections; and many not usually practised by the Student. By RICKMAN J. GODLEE, M.S., F.R.C.S., Assistant-Surgeon to University College Hospital, and Senior Demonstrator of Anatomy in University College. With 48 Imp. 4to Coloured Plates, containing 112 Figures, and a Volume of Explanatory Text, with many Engravings, 8vo, £4 14s. 6d.

HEATH.—Practical Anatomy: a Manual of Dissections. By CHRISTOPHER HEATH, F.R.C.S., Holme Professor of Clinical Surgery in University College and Surgeon to the Hospital. Fifth Edition. With 24 Coloured Plates and 269 Engravings. Crown 8vo, 15s.

ANATOMY—*continued.*

HOLDEN.—**A Manual of the Dissection of the** Human Body. By LUTHER HOLDEN, F.R.C.S., Consulting-Surgeon to St. Bartholomew's Hospital. Fourth Edition. Revised by the Author and JOHN LANGTON, F.R.C.S., Assistant Surgeon and Lecturer on Anatomy at St. Bartholomew's Hospital. With Engravings. 8vo, 16s.

By the same Author.

Human Osteology: comprising a Description of the Bones, with Delineations of the Attachments of the Muscles, the General and Microscopical Structure of Bone and its Development. Sixth Edition, revised by the Author and ALBAN DORAN, F.R.C.S., late Anatomical, now Pathological, Assistant to the Museum of the Royal College of Surgeons. With 61 Lithographic Plates and 89 Engravings. Royal 8vo. [*Nearly ready.*

ALSO,

Landmarks, Medical and Surgical. Third Edition. 8vo, 3s. 6d.

MORRIS.—**The Anatomy of the Joints of Man.** By HENRY MORRIS, M.A., F.R.C.S., Surgeon to, and Lecturer on Anatomy and Practical Surgery at, the Middlesex Hospital. With 44 Plates (19 Coloured) and Engravings. 8vo, 16s.

The Anatomical Remembrancer; or, Complete Pocket Anatomist. Eighth Edition. 32mo, 3s. 6d.

WAGSTAFFE.—**The Student's Guide to Human** Osteology. By WM. WARWICK WAGSTAFFE, F.R.C.S., Assistant-Surgeon to, and Lecturer on Anatomy at, St. Thomas's Hospital. With 23 Plates and 66 Engravings. Fcap. 8vo, 10s. 6d.

WILSON — BUCHANAN — CLARK. — **Wilson's** Anatomist's Vade-Mecum: a System of Human Anatomy. Tenth Edition, by GEORGE BUCHANAN, Professor of Clinical Surgery in the University of Glasgow, and HENRY E. CLARK, M.R.C.S., Lecturer on Anatomy in the Glasgow Royal Infirmary School of Medicine. With 450 Engravings, including 26 Coloured Plates. Crown 8vo, 18s.

BOTANY.

BENTLEY.—**A Manual of Botany. By Robert** Bentley, F.L.S., Professor of Botany in King's College and to the Pharmaceutical Society. With nearly 1200 Engravings. Fourth Edition. Crown 8vo. [*Nearly ready.*

BENTLEY AND TRIMEN.—**Medicinal Plants:** being descriptions, with original Figures, of the Principal Plants employed in Medicine, and an account of their Properties and Uses. By Robert Bentley, F.L.S., and Henry Trimen, M.B., F.L.S. In 4 Vols., large 8vo, with 306 Coloured Plates, bound in half morocco, gilt edges, £11 11s.

CHEMISTRY.

BERNAYS.—**Notes for Students in Chemistry;** being a Syllabus of Chemistry compiled mainly from the Manuals of Fownes-Watts, Miller, Wurz, and Schorlemmer. By Albert J. Bernays, Ph.D., Professor of Chemistry at St. Thomas's Hospital. Sixth Edition. Fcap. 8vo, 3s. 6d.

By the same Author.

Skeleton Notes on Analytical Chemistry, for Students in Medicine. Fcap. 8vo, 2s. 6d.

BLOXAM.—**Chemistry, Inorganic and Organic;** with Experiments. By Charles L. Bloxam, Professor of Chemistry in King's College. Fourth Edition. With nearly 300 Engravings. 8vo, 16s.

By the same Author.

Laboratory Teaching; or, Progressive Exercises in Practical Chemistry. Fourth Edition. With 83 Engravings. Crown 8vo, 5s. 6d.

CHEMISTRY—*continued.*

BOWMAN AND BLOXAM.—**Practical Chemistry,** including Analysis. By John E. Bowman, formerly Professor of Practical Chemistry in King's College, and Charles L. Bloxam, Professor of Chemistry in King's College. With 98 Engravings. Seventh Edition. Fcap. 8vo, 6s. 6d.

CLOWES.—**Practical Chemistry and Qualitative Inorganic Analysis.** An Elementary Treatise, specially adapted for use in the Laboratories of Schools and Colleges, and by Beginners. By Frank Clowes, D.Sc., Senior Science Master at the High School, Newcastle-under-Lyme. Third Edition. With 47 Engravings. Post 8vo, 7s. 6d.

FOWNES AND WATTS.—**Physical and Inorganic Chemistry.** Twelfth Edition. By George Fownes, F.R.S., and Henry Watts, B.A., F.R.S. With 154 Engravings, and Coloured Plate of Spectra. Crown 8vo, 8s. 6d.

By the same Authors.

Chemistry of Carbon - Compounds, or Organic Chemistry. Twelfth Edition. With Engravings. Crown 8vo, 10s.

LUFF.—**An Introduction to the Study of Chemistry.** Specially designed for Medical and Pharmaceutical Students. By A. P. Luff, F.I.C., F.C.S., Lecturer on Chemistry in the Central School of Chemistry and Pharmacy. Crown 8vo, 2s. 6d.

TIDY.—**A Handbook of Modern Chemistry,** Inorganic and Organic. By C. Meymott Tidy, M.B., Professor of Chemistry and Medical Jurisprudence at the London Hospital. 8vo, 16s.

VACHER.—**A Primer of Chemistry, including Analysis.** By Arthur Vacher. 18mo, 1s.

CHEMISTRY—*continued.*

VALENTIN.—**Introduction to Inorganic Chemistry.** By WILLIAM G. VALENTIN, F.C.S. Third Edition. With 82 Engravings. 8vo, 6s. 6d.

By the same Author.

A Course of Qualitative Chemical Analysis. Fifth Edition by W. R. HODGKINSON, Ph.D. (Würzburg), Demonstrator of Practical Chemistry in the Science Training Schools With Engravings. 8vo, 7s. 6d.

ALSO,

Chemical Tables for the Lecture-room and Laboratory. In Five large Sheets, 5s. 6d.

CHILDREN, DISEASES OF.

DAY.—**A Treatise on the Diseases of Children.** For Practitioners and Students. By WILLIAM H. DAY, M.D., Physician to the Samaritan Hospital for Women and Children. Crown 8vo, 12s. 6d.

ELLIS.—**A Practical Manual of the Diseases** of Children. By EDWARD ELLIS, M.D., late Senior Physician to the Victoria Hospital for Sick Children. With a Formulary. Fourth Edition. Crown 8vo, 10s.

SMITH.—**Clinical Studies of Disease in** Children. By EUSTACE SMITH, M.D., F.R.C.P., Physician to H.M. the King of the Belgians, and to the East London Hospital for Children. Post 8vo, 7s. 6d.

By the same Author.

On the Wasting Diseases of Infants and Children. Third Edition. Post 8vo, 8s. 6d.

STEINER.—**Compendium of Children's Diseases**; a Handbook for Practitioners and Students. By JOHANN STEINER, M.D. Translated by LAWSON TAIT, F.R.C.S., Surgeon to the Birmingham Hospital for Women, &c., 8vo, 12s. 6d.

DENTISTRY.

SEWILL.—**The Student's Guide to Dental** Anatomy and Surgery. By Henry E. Sewill, M.R.C.S., L.D.S., late Dental Surgeon to the West London Hospital. With 77 Engravings. Fcap. 8vo, 5s. 6d.

SMITH.—**Handbook of Dental Anatomy and** Surgery. For the Use of Students and Practitioners. By John Smith, M.D., F.R.S.E., Dental Surgeon to the Royal Infirmary, Edinburgh. Second Edition. Fcap. 8vo, 4s. 6d.

STOCKEN.—**Elements of Dental Materia Medica** and Therapeutics, with Pharmacopœia. By James Stocken, L.D.S.R.C.S., late Lecturer on Dental Materia Medica and Therapeutics and Dental Surgeon to the National Dental Hospital. Third Edition. Fcap. 8vo. [*In the press.*

TAFT.—**A Practical Treatise on Operative** Dentistry. By Jonathan Taft, D.D.S., Professor of Operative Surgery in the Ohio College of Dental Surgery. Third Edition. With 134 Engravings. 8vo, 18s.

TOMES (C. S.).—**Manual of Dental Anatomy,** Human and Comparative. By Charles S. Tomes, M.A., M.R.C.S., Lecturer on Anatomy and Physiology at the Dental Hospital of London. Second Edition. With Engravings. Crown 8vo. [*Nearly ready.*

TOMES (J. and C. S.).—**A Manual of Dental** Surgery. By John Tomes, M.R.C.S., F.R.S., and Charles S. Tomes, M.A., M.R.C.S. Second Edition. With 262 Engravings. Fcap. 8vo, 14s.

EAR, DISEASES OF.

BURNETT.—**The Ear: its Anatomy, Physiology, and Diseases.** A Practical Treatise for the Use of Medical Students and Practitioners. By Charles H. Burnett, M.D., Aural Surgeon to the Presbyterian Hospital, Philadelphia. With 87 Engravings. 8vo, 18s.

EAR, DISEASES OF—*continued.*

DALBY.—On Diseases and Injuries of the Ear. By WILLIAM B. DALBY, F.R.C.S., Aural Surgeon to, and Lecturer on Aural Surgery at, St. George's Hospital. Second Edition. With Engravings. Fcap. 8vo, 6s. 6d.

JONES.—A Practical Treatise on Aural Surgery. By H. MACNAUGHTON JONES, M.D., Professor of the Queen's University in Ireland, Surgeon to the Cork Ophthalmic and Aural Hospital. With 62 Engravings. Crown 8vo, 8s. 6d.

By the same Author.

Atlas of the Diseases of the Membrana Tympani. In Coloured Plates, containing 59 Figures. With Explanatory Text. Crown 4to, 21s.

FORENSIC MEDICINE.

OGSTON.—Lectures on Medical Jurisprudence. By FRANCIS OGSTON, M.D., Professor of Medical Jurisprudence and Medical Logic in the University of Aberdeen. Edited by FRANCIS OGSTON, Jun., M.D., Assistant to the Professor of Medical Jurisprudence and Lecturer on Practical Toxicology in the University of Aberdeen. With 12 Plates. 8vo, 18s.

TAYLOR.—The Principles and Practice of Medical Jurisprudence. By ALFRED S. TAYLOR, M.D., F.R.S., late Professor of Medical Jurisprudence to Guy's Hospital. Second Edition. With 189 Engravings. 2 Vols. 8vo, 31s. 6d.

By the same Author.

A Manual of Medical Jurisprudence. Tenth Edition. With 55 Engravings. Crown 8vo, 14s.

ALSO,

On Poisons, in relation to Medical Jurisprudence and Medicine. Third Edition. With 104 Engravings. Crown 8vo, 16s.

WOODMAN AND TIDY.—A Handy-Book of Forensic Medicine and Toxicology. By W. BATHURST WOODMAN, M.D., F.R.C.P.; and C. MEYMOTT TIDY, M.B. With 8 Lithographic Plates and 116 Wood Engravings. 8vo, 31s. 6d.

HYGIENE.

PARKES.—**A Manual of Practical Hygiene.** By Edmund A. Parkes, M.D., F.R.S. Fifth Edition by F. De Chaumont, M.D., F.R.S., Professor of Military Hygiene in the Army Medical School. With 9 Plates and 112 Engravings. 8vo, 18s.

WILSON.—**A Handbook of Hygiene and Sanitary Science.** By George Wilson, M.A., M.D., Medical Officer of Health for Mid Warwickshire. Fourth Edition. With Engravings. Crown 8vo, 10s. 6d.

MATERIA MEDICA AND THERAPEUTICS.

BINZ AND SPARKS.—**The Elements of Therapeutics:** a Clinical Guide to the Action of Medicines. By C. Binz, M.D., Professor of Pharmacology in the University of Bonn. Translated and Edited with Additions, in conformity with the British and American Pharmacopœias, by Edward I. Sparks, M.A., M.B., F.R.C.P. Lond. Crown 8vo, 8s. 6d.

OWEN.—**Tables of Materia Medica; comprising** the Contents, Doses, Proportional Composition, and Methods of Manufacture of Pharmacopœial Preparations. By Isambard Owen, M.B., M.R.C.P., Lecturer on Materia Medica at St. George's Hospital. Fifth Edition. Crown 8vo, 2s. 6d.

ROYLE AND HARLEY.—**A Manual of Materia** Medica and Therapeutics. By J. Forbes Royle, M.D., F.R.S., and John Harley, M.D., F.R.C.P., Physician to, and Joint Lecturer on Clinical Medicine at, St. Thomas's Hospital. Sixth Edition. With 139 Engravings. Crown 8vo, 15s.

THOROWGOOD.—**The Student's Guide to** Materia Medica. By John C. Thorowgood, M.D., F.R.C.P., Lecturer on Materia Medica at the Middlesex Hospital. With Engravings. Fcap. 8vo, 6s. 6d.

WARING.—**A Manual of Practical Therapeutics.** By Edward J. Waring, C.B., M.D., F.R.C.P. Third Edition. Fcap. 8vo, 12s. 6d.

MEDICINE.

BARCLAY.—**A Manual of Medical Diagnosis.** By A. Whyte Barclay, M.D., F.R.C.P., Physician to, and Lecturer on Medicine at, St. George's Hospital. Third Edition. Fcap. 8vo, 10s. 6d.

CHARTERIS.—**The Student's Guide to the** Practice of Medicine. By Matthew Charteris, M.D., Professor of Materia Medica, University of Glasgow; Physician to the Royal Infirmary. With Engravings on Copper and Wood. Third Edition. Fcap. 8vo, 7s.

FENWICK.—**The Student's Guide to Medical** Diagnosis. By Samuel Fenwick, M.D., F.R.C.P., Physician to the London Hospital. Fifth Edition. With 111 Engravings. Fcap. 8vo, 7s.

By the same Author.

The Student's Outlines of Medical Treatment. Second Edition. Fcap. 8vo, 7s.

FLINT.—**Clinical Medicine : a Systematic Trea**tise on the Diagnosis and Treatment of Disease. By Austin Flint, M.D., Professor of the Principles and Practice of Medicine, &c., in Bellevue Hospital Medical College. 8vo, 20s.

HALL.—**Synopsis of the Diseases of the Larynx,** Lungs, and Heart : comprising Dr. Edwards' Tables on the Examination of the Chest. With Alterations and Additions. By F. De Havilland Hall, M.D., F.R.C.P., Assistant-Physician to the Westminster Hospital. Royal 8vo, 2s. 6d.

SANSOM.—**Manual of the Physical Diagnosis** of Diseases of the Heart, including the use of the Sphygmograph and Cardiograph. By A. E. Sansom, M.D., F.R.C.P., Assistant-Physician to the London Hospital. Third Edition, with 47 Woodcuts. Fcap. 8vo, 7s. 6d.

WARNER.—**Student's Guide to Medical Case-**Taking. By Francis Warner, M.D., Assistant-Physician to the London Hospital. Fcap. 8vo, 5s.

MEDICINE—*continued.*

WHITTAKER.—Students' Primer on the Urine. By J. TRAVIS WHITTAKER, M.D., Clinical Demonstrator at the Royal Infirmary, Glasgow. With Illustrations, and 16 Plates etched on Copper. Post 8vo, 4s. 6d.

MIDWIFERY.

BARNES.—Lectures on Obstetric Operations, including the Treatment of Hæmorrhage, and forming a Guide to the Management of Difficult Labour. By ROBERT BARNES, M.D., F.R.C.P., Obstetric Physician to, and Lecturer on Diseases of Women, &c., at St. George's Hospital. Third Edition. With 124 Engravings. 8vo, 18s.

CLAY.—The Complete Handbook of Obstetric Surgery; or, Short Rules of Practice in every Emergency, from the Simplest to the most formidable Operations connected with the Science of Obstetricy. By CHARLES CLAY, M.D., late Senior Surgeon to, and Lecturer on Midwifery at, St. Mary's Hospital, Manchester. Third Edition. With 91 Engravings. Fcap. 8vo, 6s. 6d.

RAMSBOTHAM.—The Principles and Practice of Obstetric Medicine and Surgery. By FRANCIS H. RAMSBOTHAM, M.D., formerly Obstetric Physician to the London Hospital. Fifth Edition. With 120 Plates, forming one thick handsome volume. 8vo, 22s.

REYNOLDS.—Notes on Midwifery: specially designed to assist the Student in preparing for Examination. By J. J. REYNOLDS, M.R.C.S. Fcap. 8vo, 4s.

ROBERTS.—The Student's Guide to the Practice of Midwifery. By D. LLOYD ROBERTS, M.D., F.R.C.P., Physician to St. Mary's Hospital, Manchester. Second Edition. With 111 Engravings. Fcap. 8vo, 7s.

SCHROEDER.—A Manual of Midwifery; including the Pathology of Pregnancy and the Puerperal State. By KARL SCHROEDER, M.D., Professor of Midwifery in the University of Erlangen. Translated by CHARLES H. CARTER, M.D. With Engravings. 8vo, 12s. 6d.

MIDWIFERY—*continued.*

SWAYNE.—Obstetric Aphorisms for the Use of Students commencing Midwifery Practice. By JOSEPH G. SWAYNE, M.D., Lecturer on Midwifery at the Bristol School of Medicine. Seventh Edition. With Engravings. Fcap. 8vo, 3s. 6d.

MICROSCOPY.

CARPENTER.—The Microscope and its Revelations. By WILLIAM B. CARPENTER, C.B., M.D., F.R.S. Sixth Edition. With 26 Plates, a Coloured Frontispiece, and more than 500 Engravings. Crown 8vo, 16s.

MARSH.—Section-Cutting: a Practical Guide to the Preparation and Mounting of Sections for the Microscope, special prominence being given to the subject of Animal Sections. By Dr. SYLVESTER MARSH. With Engravings. Fcap. 8vo, 2s. 6d.

MARTIN.—A Manual of Microscopic Mounting. By JOHN H. MARTIN, Member of the Society of Public Analysts, &c. Second Edition. With several Plates and 144 Engravings. 8vo, 7s. 6d.

OPHTHALMOLOGY.

DAGUENET.—A Manual of Ophthalmoscopy for the Use of Students. By Dr. DAGUENET. Translated by C. S. JEAFFRESON, Surgeon to the Newcastle-on-Tyne Eye Infirmary. With Engravings. Fcap. 8vo, 5s.

HIGGENS.—Hints on Ophthalmic Out-Patient Practice. By CHARLES HIGGENS, F.R.C.S., Ophthalmic Assistant-Surgeon to, and Lecturer on Ophthalmology at, Guy's Hospital. Second Edition. Fcap. 8vo, 3s.

JONES.—A Manual of the Principles and Practice of Ophthalmic Medicine and Surgery. By T. WHARTON JONES, F.R.C.S., F.R.S., late Ophthalmic Surgeon and Professor of Ophthalmology to University College Hospital. Third Edition. With 9 Coloured Plates and 173 Engravings. Fcap. 8vo, 12s. 6d.

OPHTHALMOLOGY—*continued.*

MACNAMARA.—**A Manual of the Diseases of** the Eye. By CHARLES MACNAMARA, F.R.C.S., Surgeon to Westminster Hospital. Third Edition. With 7 Coloured Plates and 52 Engravings. Fcap. 8vo, 12s. 6d.

NETTLESHIP.—**The Student's Guide to Diseases** of the Eye. By EDWARD NETTLESHIP, F.R.C.S., Ophthalmic Surgeon to, and Lecturer on Ophthalmic Surgery at, St. Thomas's Hospital. With 48 Engravings. Fcap. 8vo, 7s. 6d.

WOLFE.—**On Diseases and Injuries of the Eye:** a Course of Systematic and Clinical Lectures to Students and Medical Practitioners. By J. R. WOLFE, M.D., F.R.C.S.E., Senior Surgeon to the Glasgow Ophthalmic Institution, Lecturer on Ophthalmic Medicine and Surgery in Anderson's College. With 10 Coloured Plates, and 120 Wood Engravings, 8vo.

PATHOLOGY.

JONES AND SIEVEKING.—**A Manual of Pathological Anatomy.** By C. HANDFIELD JONES, M.B., F.R.S., and EDWARD H. SIEVEKING, M.D., F.R.C.P. Second Edition. Edited, with considerable enlargement, by J. F. PAYNE, M.B., Assistant-Physician and Lecturer on General Pathology at St. Thomas's Hospital. With 195 Engravings. Crown 8vo, 16s.

LANCEREAUX.—**Atlas of Pathological Anatomy.** By Dr. LANCEREAUX. Translated by W. S. GREENFIELD, M.D., Professor of Pathology in the University of Edinburgh. With 70 Coloured Plates. Imperial 8vo. £5 5s.

VIRCHOW. — **Post-Mortem Examinations: a** Description and Explanation of the Method of Performing them, with especial reference to Medico-Legal Practice. By Professor RUDOLPH VIRCHOW, Berlin Charité Hospital. Translated by Dr. T. B. SMITH. Second Edition, with 4 Plates. Fcap. 8vo, 3s. 6d.

WILKS AND MOXON.—**Lectures on Pathological Anatomy.** By SAMUEL WILKS, M.D., F.R.S., Physician to, and Lecturer on Medicine at, Guy's Hospital; and WALTER MOXON, M.D., F.R.C.P., Physician to, and Lecturer on Clinical Medicine at, Guy's Hospital. Second Edition. With 7 Steel Plates. 8vo, 18s.

PSYCHOLOGY.

BUCKNILL AND TUKE.—**A Manual of Psychological Medicine**: containing the Lunacy Laws, Nosology, Ætiology, Statistics, Description, Diagnosis, Pathology, and Treatment of Insanity, with an Appendix of Cases. By John C. Bucknill, M.D., F.R.S., and D. Hack Tuke, M.D., F.R.C.P. Fourth Edition, with 12 Plates (30 Figures). 8vo, 25s.

PHYSIOLOGY.

CARPENTER.—**Principles of Human Physiology.** By William B. Carpenter, C.B., M.D., F.R.S. Ninth Edition. Edited by Henry Power, M.B., F.R.C.S. With 3 Steel Plates and 377 Wood Engravings. 8vo, 31s. 6d.

DALTON.—**A Treatise on Human Physiology**: designed for the use of Students and Practitioners of Medicine. By John C. Dalton, M.D., Professor of Physiology and Hygiene in the College of Physicians and Surgeons, New York. Sixth Edition. With 316 Engravings. Royal 8vo, 20s.

FREY.—**The Histology and Histo-Chemistry of Man.** A Treatise on the Elements of Composition and Structure of the Human Body. By Heinrich Frey, Professor of Medicine in Zurich. Translated by Arthur E. Barker, Assistant-Surgeon to the University College Hospital. With 608 Engavings. 8vo, 21s.

RUTHERFORD.—**Outlines of Practical Histology.** By William Rutherford, M.D., F.R.S., Professor of the Institutes of Medicine in the University of Edinburgh; Examiner in Physiology in the University of London. Third Edition. With Engravings. Crown 8vo (with additional leaves for Notes). [*In preparation.*

SANDERSON.—**Handbook for the Physiological Laboratory**: containing an Exposition of the fundamental facts of the Science, with explicit Directions for their demonstration. By J. Burdon Sanderson, M.D., F.R.S., Jodrell Professor of Physiology in University College; E. Klein, M.D., F.R.S., Assistant-Professor in the Brown Institution; Michael Foster, M.D., F.R.S., Prælector of Physiology at Trinity College, Cambridge; and T. Lauder Brunton, M.D., F.R.S., Lecturer on Materia Medica at St. Bartholomew's Hospital Medical College. 2 Vols., with 123 Plates. 8vo, 24s.

SURGERY.

BRYANT.—**A Manual for the Practice of** Surgery. By Thomas Bryant, F.R.C.S., Surgeon to, and Lecturer on Surgery at, Guy's Hospital. Third Edition. With 672 Engravings (nearly all original, many being coloured). 2 vols. Crown 8vo, 28s.

BELLAMY.—**The Student's Guide to Surgical** Anatomy; a Description of the more important Surgical Regions of the Human Body, and an Introduction to Operative Surgery. By Edward Bellamy, F.R.C.S., and Member of the Board of Examiners; Surgeon to, and Lecturer on Anatomy at, Charing Cross Hospital. Second Edition. With 76 Engravings. Fcap. 8vo, 7s.

CLARK AND WAGSTAFFE.—**Outlines of** Surgery and Surgical Pathology. By F. Le Gros Clark, F.R.C.S., F.R.S., Consulting Surgeon to St. Thomas's Hospital. Second Edition. Revised and expanded by the Author, assisted by W. W. Wagstaffe, F.R.C.S., Assistant-Surgeon to St. Thomas's Hospital. 8vo, 10s. 6d.

DRUITT.—**The Surgeon's Vade-Mecum; a** Manual of Modern Surgery. By Robert Druitt, F.R.C.S. Eleventh Edition. With 369 Engravings. Fcap. 8vo, 14s.

FERGUSSON.—**A System of Practical Surgery.** By Sir William Fergusson, Bart., F.R.C.S., F.R.S., late Surgeon and Professor of Clinical Surgery to King's College Hospital. With 463 Engravings. Fifth Edition. 8vo, 21s.

HEATH.—**A Manual of Minor Surgery and** Bandaging, for the use of House-Surgeons, Dressers, and Junior Practitioners. By Christopher Heath, F.R.C.S., Holme Professor of Clinical Surgery in University College and Surgeon to the Hospital. Sixth Edition. With 115 Engravings. Fcap. 8vo. 5s. 6d.

By the same Author.

A Course of Operative Surgery: with Twenty Plates drawn from Nature by M. Léveillé, and Coloured by hand under his direction. Large 8vo, 40s.

ALSO,

The Student's Guide to Surgical Diagnosis. Fcap. 8vo, 6s. 6d.

SURGERY—*continued.*

MAUNDER.—**Operative Surgery.** By Charles F. Maunder, F.R.C.S., late Surgeon to, and Lecturer on Surgery at, the London Hospital. Second Edition. With 164 Engravings. Post 8vo, 6s.

PIRRIE.—**The Principles and Practice of Surgery.** By William Pirrie, F.R.S.E., Professor of Surgery in the University of Aberdeen. Third Edition. With 490 Engravings. 8vo, 28s.

TERMINOLOGY.

DUNGLISON.—**Medical Lexicon: a Dictionary** of Medical Science, containing a concise Explanation of its various Subjects and Terms, with Accentuation, Etymology, Synonymes, &c. By Robley Dunglison, M.D. New Edition, thoroughly revised by Richard J. Dunglison, M.D. Royal 8vo, 28s.

MAYNE.—**A Medical Vocabulary: being an** Explanation of all Terms and Phrases used in the various Departments of Medical Science and Practice, giving their Derivation, Meaning, Application, and Pronunciation. By Robert G. Mayne, M.D., LL.D., and John Mayne, M.D., L.R.C.S.E. Fifth Edition. Fcap. 8vo, 10s. 6d.

WOMEN, DISEASES OF.

BARNES.—**A Clinical History of the Medical** and Surgical Diseases of Women. By Robert Barnes, M.D., F.R.C.P., Obstetric Physician to, and Lecturer on Diseases of Women, &c., at, St. George's Hospital. Second Edition. With 181 Engravings. 8vo, 28s.

DUNCAN.—**Clinical Lectures on the Diseases** of Women. By J. Matthews Duncan, M.D., Obstetric Physician to St. Bartholomew's Hospital. 8vo, 8s.

EMMET. — **The Principles and Practice of** Gynæcology. By Thomas Addis Emmet, M.D., Surgeon to the Woman's Hospital of the State of New York. With 130 Engravings. Royal 8vo, 24s.

WOMEN, DISEASES OF—*continued.*

GALABIN.—**The Student's Guide to the Diseases of Women.** By Alfred L. Galabin, M.D., F.R.C.P., Assistant Obstetric Physician and Joint Lecturer on Obstetric Medicine at Guy's Hospital. Second Edition. With 70 Engravings. Fcap. 8vo, 7s. 6d.

REYNOLDS.—**Notes on Diseases of Women.** Specially designed for Students preparing for Examination. By J. J. Reynolds, M.R.C.S. Fcap. 8vo, 2s. 6d.

SMITH.—**Practical Gynæcology: a Handbook** of the Diseases of Women. By Heywood Smith, M.D., Physician to the Hospital for Women and to the British Lying-in Hospital. With Engravings. Crown 8vo, 5s. 6d.

WEST AND DUNCAN.—**Lectures on the Diseases of Women.** By Charles West, M.D., F.R.C.P. Fourth Edition. Revised and in part re-written by the Author, with numerous additions, by J. Matthews Duncan, M.D., Obstetric Physician to St. Bartholomew's Hospital. 8vo, 16s.

ZOOLOGY.

CHAUVEAU AND FLEMING.—**The Comparative Anatomy of the Domesticated Animals.** By A. Chauveau, Professor at the Lyons Veterinary School; and George Fleming, Veterinary Surgeon, Royal Engineers. With 450 Engravings. 8vo, 31s. 6d.

HUXLEY.—**Manual of the Anatomy of Invertebrated Animals.** By Thomas H. Huxley, LL.D., F.R.S. With 156 Engravings. Fcap. 8vo, 16s.

By the same Author.

Manual of the Anatomy of Vertebrated Animals. With 110 Engravings. Post 8vo, 12s.

WILSON.—**The Student's Guide to Zoology:** a Manual of the Principles of Zoological Science. By Andrew Wilson, Lecturer on Natural History, Edinburgh. With Engravings. Fcap. 8vo, 6s. 6d.

14783

M684 Macnamara, C. i.e. N. C.
M16 Lectures on diseases
1881 of bones and joints.

NAME	DATE DUE

M684
M16
1881